NAVY CIVIL Engineer

WINTER 1983/84

Who were the first SEABEES

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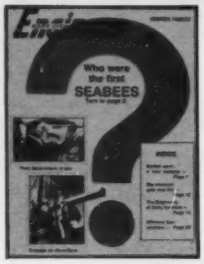

THE COVER

Ever since the Seabees were formed there has been a certain amount of controversy over "who was first." In an attempt to settle the question at last, an expert in the field has researched the subject and offers his findings on page 3.

Navy Civil Engineer

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speaking from topside

departments

"Be glad of your part in this grand enterprise"

Three events occurred which caused me to pause and reflect on the nature of the Civil Engineer Corps. I want to share them with you.

Four of our retired flag officers accepted my invitation to return to headquarters for a day and meet with me and the active duty flag officers. They were Rear Admiral Jim Bartlett, Rear Admiral Jack Dillon, Rear Admiral Bob Jortberg, and Rear Admiral Paul Gates. Most of you recognize their names and remember their substantial contributions to our Corps, our Navy, and our country.

These are men of extraordinary success, sagacity, and judgment. We in the active ranks took advantage of their perspective in assessing how well the Corps is carrying out its responsibilities. As you can imagine, it was an intellectually honest and challenging session, worthy of our high purpose.

I am happy to report to you that these retired flag officers credited their experience in the Corps, and the way we manage, for their continued success in the civilian sector. Our concerns in the Corps are the same as their concerns in the civilian sector — how to stimulate performance; how to manage risk; how to realize quality. We in the active ranks took comfort from these shared values and identical intentions. It was a professional meeting in the best sense of the word.

Another event occurred earlier, while I undertook a three-week inspection and visit of our operations in the Western Pacific. The commanders and commanding officers of naval activities there were uniform in their high praise for the Corps and the Naval Facilities Engineering Command. I, too, found our officers and civilians on duty there to be doing a good job and in good spirits.

Morale is infectious; and good morale is fundamental to good performance. I am happy to report to you that I found both among our officers, Seabees, and civilians in the four PWC's, three OICC's, and three battalions I visited. It was clear to me that the morale, the spirit, the leadership we have in place in the Western Pacific is our most important contribution to our country's objectives there.

The third event of which I speak was the autumn Commander's Conference in headquarters. The commanders and commanding officers of our EFD's, the CBC's, NCEL, and CECOS, and OICC Trident were aboard to discuss the professional, management, and technical issues we face.

Around one table we assembled the officers holding positions of greatest responsibility in the Corps — officers of unquestioned integrity and unwaivering goodwill. It was interesting, reassuring, even inspiring, to participate in the discussions with these men.

Together they sought an excellence not compromised by time,

rank, or emotion; they displayed a loyalty not sullied by ambition, pride, or ego; and they made judgments not influenced by the momentum of numbers, precedent, or fatigue. They were — and are — officers of the Corps and all that it stands for.

I encourage you to consider these events as the indicators I think them to be of the nature of our Corps. Be glad of your part in this grand enterprise of ours. I am.

WILLIAM M. ZOBEL
Rear Admiral, CEC, USN
Commander
and
Chief of Civil Engineers

An answer to the controversial question . . .

Who were the first Seabees

By VINCENT A. TRANSANO, Ph.D.
Command Historian
NAVFAC

An early Seabee sights land somewhere in the Pacific. The year was 1942.

Prior to Pearl Harbor, there were no Seabee battalions at all. The "Naval Construction Battalion" concept had been in the contingency plans of the Bureau of Yards and Docks since the early 1930's; however, implementing and operating procedures needed to turn this idea into reality had not been developed. Nevertheless, during the months preceding Pearl Harbor, the Navy took the first tentative steps toward the creation of a military construction force.

Anticipating possible U.S. involvement in the Second World War, the Navy was already expanding existing facilities and building new ones at a great many overseas locations during the summer of 1941. To facilitate this work, the Bureau of Yards and Docks planned to establish a new type of military unit, the Headquarters Construction Company, which would be composed of two officers and ninety-nine enlisted men.

Under the direction of the Officer in Charge of Construction, the men of the company were to serve as draftsmen, engineering aids, and inspectors. They were to perform administrative duties and oversee the work of civilian construction contractors, but were not, themselves, to perform actual construction work.

Rear Admiral Chester W. Nimitz, then Chief of the Bureau of Navigation (the forerunner of today's Naval Military Personnel Command), authorized the first Headquarters Construction Company on October 31, 1941. By December 1, 1941, men had been recruited for the unit and were undergoing basic training at the Newport Naval Station in Rhode Island. On December 16, 1941, the Navy authorized four additional companies. However, the attack on Pearl Harbor, which preceded this authorization by a week, quickly led to the abandonment of the entire Headquarters Construction Company program.

The use of civilian workers in what was now the war zone was no longer practical because they would be exposed to enemy attack. If the workers tried to defend themselves, they could be shot as guerillas if captured. What the Navy needed was a militarized construction force which could defend what it built.

Rear Admiral Ben Moreell, Chief of the Bureau of Yards and Docks, requested authority to raise such construction units on Decemter 28, 1941. On January 5, 1942, the Bureau of Navigation granted him authority to recruit experienced construction workers and organize them into a construction regiment composed of three battalions.

Events, however, outran planning. The Navy immediately needed a fueling station built on Bora Bora in the French Society Islands to support the ships and planes that were

They remember the humble beginnings out in the Pacific...

RAdm. Harry N. Wallin (Ret)

1942 (Lt.)

1983

"Despite being poorly equipped, short-handed, fighting malaria, and facing an extremely urgent schedule, our half of the 'First NCB' . . . performed miracles. They were eager, dedicated, hard working, and cooperative. They worked hard seven days a week . . . without complaining.

"By landing in the New Hebrides the same day the Japanese landed on Guadalcanal and Tulagi . . . just three months before our Marines landed there, we were able to build airfields, hospitals, and other facilities to support the Guadalcanal invasion. It was the turning point of WWII in the Pacific. I'll never forget that beautiful sight of our fighting ships steaming past our island headed for the Solomons just a few days before the invasion of August 7, 1942. No other assignment in my 30-year career gave me as much personal satisfaction of achievement — and it was due to my officers and men. They were great."

Charles E. Mischler

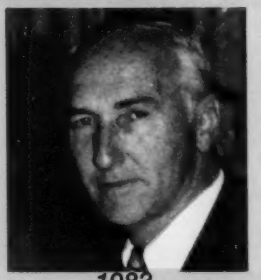
1943 (YN1)

1983

"I was a volunteer for the Seabees. Never did I ever feel I made a wrong choice. The men that made up the 'First C. B. Battalion' were the greatest bunch of craftsmen and workers ever gathered in one outfit."

Herbert Lee Van Keuren

1944 (SK1)



1983

"The 'First C. B. Battalion' was a super outfit and we proved it. Just think, we put down the bomber strip on Espiritu Santo in 29 days and it opened the beginning of the downfall of the Japanese when our bombers, B-17s, took off for Guadacanal."

keeping open the sea lanes to Australia. There was no time to complete the organization and training of the newly authorized construction regiment; construction men were needed at once on Bora Bora!

To meet the demands of this critical situation, the Bureau of Yards and Docks proposed to immediately organize a single construction battalion to be known as "Construction Battalion BOBCAT." after Bora Bora's code name "BOBCAT." The battalion was to be formed around the First Headquarters Construction Company which had been trained and equipped for an assignment in Iceland but was still at Newport, Rhode Island.

To this already-formed unit, which contained many experienced construction men, was added approximately 150 general service recruits, without any construction experience, from the Newport Basic Training Camp. The unit was to consist initially of eight officers and 250 enlisted men. Additional personnel drafts were to subsequently increase its size.

The Bureau of Yards and Docks approved the draft organization of Construction Battalion BOBCAT on January 9, 1942; and on January 10, BuDocks requested that the Bureau of Navigation also approve the new unit and issue orders for its establishment.

The Bureau of Navigation did so and the personnel of the new battalion assembled at the Naval Air Station, Quonset Point, Rhode Island, for a brief familiarization course in construction equipment operation and Quonset hut erection.

Following this training, BuDocks shipped the group to Charleston, South Carolina where the battalion was to be officially formed and then depart for Bora Bora.

On January 14, 1942, the Bureau of Navigation ordered LCdr. Harold MacT. Sylvester, CEC, USN, to report to the Commandant, Sixth Naval district at Charleston "...for duty in connection with the organization of the First Construction Battalion and as officer in charge of that battalion when organized." On January 21, 1942,

RAdm. Louis R. La Porte (Ret)

1942 (LCdr.)

1983

The men in these time-worn photographs saw first-hand, the birth and development of the military force whose motto is . . . we build — we fight!

"I firmly believe that the Bobcats hold a very special entity in the annals of the Seabees. With little training and limited equipment, they accomplished missions that very often seemed impossible. They personified the real meaning of the Seabee slogan 'Can Do' or having 'The Right Stuff.'
"I can recall many of their exploits from building a fueling depot to constructing an airfield. They performed each of their assigned tasks skillfully and commendably. They volunteered, and worked untiringly around the clock to repair battle-damaged ships that came for refueling so that they could speedily return to the battle area.
"The Bobcats were proud and they were mighty. I was privileged to have been their commanding officer."

Arthur Risley

1942 (CM1)

1983

"I volunteered for the Seabees in February 1942. The 'First' was organized confusion in the beginning, but we got the job done."

John E. Wilson

1943 (YNC)

1982

"January through March 1942 were the first three months I spent in the Navy — and it was one mad push from one camp to another. But when we — the 'First' — got out on the islands of Tongatabu and Efate and went to work, we founded the phrase 'Can Do'."

LCdr. Sylvester informed the Bureau of Navigation that "The organization of the Battalion was completed and the Battalion was placed in service by the Commandant, Sixth Naval District [RAdm. William H. Allan, USN] at 11:00 a.m. this date."

Although called a "battalion," the new unit only had the actual strength of a reinforced company. Despite this, it was commanded by a lieutenant commander and was officially designated the "First Construction Battalion, USN." Only six days after its establishment, on January 27, the First Construction Battalion shipped out for Bora Bora.

While this unit might be the first construction battalion, its personnel did not call themselves Seabees. The term "Seabee" was not coined until a month after the First Construction Battalion's departure and it was not approved for use by the Bureau of Navigation until March 5, 1942.

Lacking a name, the construction men of the new unit began to call themselves Bobcats after their destination's code name. They did not know that they were Seabees until a 120-man draft for the unit arrived on Bora Bora in June 1942. The new men called themselves Seabees and the old Bobcats learned to respect the new name when they subsequently heard of Seabee exploits on Guadalcanal.

While the Bobcats might now be Seabees, their unit was no longer the First Construction Battalion. For on March 26, 1942, the Bureau of Yards and Docks had requested of the Bureau of Navigation " . . . that the referenced orders [of January 14, 1942] issued to Lieutenant Commander H. M. Sylvester, CEC, USN, Bobcat, be so far modified as to designate him as Officer in Charge of the First Construction **Detachment**, in lieu of the First Construction **Battalion**." To understand this change in designation, we must go back once again to January 1942.

During that month planning was underway not only for a construction unit at Bora Bora, but also for two additional units which would be sent to Tongatabu (code name BLEACHER) in the Tonga Islands and Efate (code

name ROSES) in the New Hebrides Islands. On January 15, 1942, a week before the First Construction Battalion was established at Charleston, a Bu-Docks memorandum recommended 16 CEC officers " . . . for duty with Construction Battalion Detachments for Bleacher and Roses."

As it turned out, the two proposed detachments were not formed separately, but were formed as a single battalion on March 15, 1942 at Camp Allen, Norfolk, Virginia. The new battalion was designated the First Construction Battalion! However, unlike the "battalion" formed at Charleston on January 21, 1942, this First Construction Battalion had a normal table of organization: one headquarters company and four construction companies with a total complement of about 1,080 men. On April 1, 1942 the new battalion was officially divided into two detachments (as originally anticipated in the planning). One half of the headquarters company and "A" and "B" companies became the Second Construction Detachment, commanded by LCdr. Forrest E. Byrns, CEC, USNR. The remainder of the headquarters company and companies "C" and "D" became the Third Construction Detachment, commanded by Lt. (later RAdm.) Harry N. Wallin, CEC, USN.

There now existed three construction detachments: the First was building fueling facilities on Bora Bora, while the Second and Third completed their training at Camp Allen. On April 8, 1942, the Second Detachment departed for Tongatabu to build a fueling station and air base. Four days later, on April 12, the Third Construction Detachment departed for Efate to build a forward air base.

The Bobcats of the First Construction Detachment had during the rest of that unit's existence absolutely no connection with the Second and Third Construction Detachments. The Bobcats remained on Bora Bora until September 1943. By that time, the war had moved west and Bora Bora had become a backwater. On September 11, 1943, the First Construction Detachment departed for Noumea, New Caledonia (leaving behind two officers and thirty-one men to train Construction Battalion Maintenance Unit 519 in base maintenance when that unit arrived).

En route to their new destination, the Bobcats were diverted to the Samoan Islands and they landed at Pago Pago on September 16, 1943. The First Construction Detachment was now redesignated the "Naval Construction Company" and assigned to the 22nd Marine Regiment, Reinforced.

During the next seven months, the Bobcats not only performed general construction work, but also saw action in assault engineer squads and demolition squads during the campaign in the Marshall Islands.

After twenty-six months of tropical campaigning, on April 17, 1944, the Bobcats were once again designated the "First Construction Detachment" and were shortly after detached from the Marines. On May 5, 1944, the detachment was attached to Naval Construction Battalion Three for return to the United States with that unit. On June 7, 1944, the First Construction Detachment was inactivated at the Construction Battalion Replacement Depot, Camp Parks, California.

"A certain amount of confusion clouds the origins and early history of the first Seabee Battalion. In fact, for a few days in March 1942, two "first battalions" existed."

V. Transano

The Second Construction detachment remained on Tongatabu until February 1943 where it completed numerous projects. Among these was the installation of a concrete bulkhead in the damaged aircraft carrier SARATOGA. On February 23, 1943, the Second Construction Detachment left Tongatabu for Efate where it was to join the Third Construction Detachment. (A 160-man detachment was left behind; it did not arrive on Efate until December 8, 1943.)

The Third Construction Detachment also completed a great number of significant projects while in the New Hebrides Islands. The most important involved forward air base construction.

Not only did the detachment build an airfield and supporting facilities on Efate, but part of the detachment also built an extremely important airfield on Espiritu Santo (code name BUTTONS). This 6,000 foot coral-surfaced field was built in only 20 days.

Its completion allowed U.S. aircraft to begin bombing the Japanese airfield on Guadalcanal before it could be completed and planes from it sent into action against U.S. forces.

On March 1, 1943, the Second Construction Detachment arrived at Efate. Six weeks later, on April 14, 1943, the Second and Third Construction Detachments were inactivated and the "First Construction Battalion" was reformed.

LCdr. Byrns, the officer in charge of the Second Detachment, assumed command of the battalion. (The men left behind on Tongatabu by the Second Detachment now became the "EDIT" Detachment of Naval Construction Battalion One.)

Naval Construction Battalion One continued to operate on Efate unitl mid-February 1944, when, after almost two years in the tropics, it returned to the United States. The battalion arrived at San Francisco on March 7, 1944, and that same day was shipped to Camp Parks, California. On June 13, 1944, Naval Construction Battalion One was disestablished and its personnel assigned to other battalions.

Thus ends the strange tale of the two "first battalions." The Bobcats were the first officially established "construction battalion," despite the fact that the unit's original strength was only eight officers and 250 men.

The unit was established as the First Construction Battalion because the Bureau of Yards and Docks had presumably planned to augment it with additional personnel and bring it up to battalion strength. The plan was, however, quickly abandoned.

Less than two months after the Bobcats sailed for Bora Bora, the Navy established another First Construction Battalion. This full-strength battalion has the distinction of being the "first battalion" in reality as well as in name.

One final point should be emphasized again: the First contruction Detachment (the Bobcats) had absolutely no connection — either organizationally or as regards service — with the Second and Third Detachments.

While the Second and Third Construction Detachments were originally part of the same battalion and while they were reformed as such in early 1943, the First Construction Detachment had an entirely separate existence. □

A 'new' construction material with versatility

Although very new as an engineering construction material, reinforced earth has demonstrated wide versatility and suitability while cutting costs between 20 and 50 percent on engineering projects.

Many technical advantages are gained by the use of reinforced earth vis-a-vis conventional construction materials. Indeed, reinforced earth is often the only feasible solution to construction problems due to its unique properties.

By LT JAMES F. McCOLLUM,
CEC, USN
P.E., Conn

As with all construction materials, the largest hurdles to clear before gaining acceptance by designers/constructors is cost effectiveness and ease of construction. These factors are the basic strengths of reinforced earth.

As a result, reinforced earth construction projects have been rapidly increasing in number since its "introduction" in 1970 on all continents, at a rate that nearly doubles each year.

The reinforced earth industry and the variation of applications of this construction material will continue to expand rapidly.

Reinfinements of design will reduce costs even further as in-situ backfill, decreased excavation, more efficient design, and wider construction experience potentials are realized.

The original patent rights held by Henri Vidal will expire in January 1986 and the market will then be wide open to development.

The use of earth reinforcement, the strengthening of a soil structure by materials installed to resist tension, has in recent years become widespread. The predominant method is Reinforced Earth, a patented construction material developed in France and introduced to the U.S. in the late 1960s.

Another patented European concept is the Root Pile which was developed in Italy. Other reinforcement concepts include the use of nets, fabrics, earth anchors, or grids. Some are variations of others, some are experimental, but all have the same purpose — to increase the strength of a soil mass.

Initially, earth-reinforcement projects were designed with very high safety factors, but experience led to better, more economical designs, with broadened applications.

DEFINITION AND BACKGROUND

Reinforced earth is a construction material composed of soil-fill strengthened by the inclusion of rods, bars, fibers, or nets *which interact with the soil by means of frictional resistance*. A broader definition could also include the use of rock bolts or earth anchors to improve the qualities of natural deposits in situ.

The basic components of a reinforced earth wall (Figure 1) consist of a facing wall and compacted soil backfill reinforced with thin metallic strips. The strips, normally galvanized steel, absorb tensile stresses in the backfill by strip/soil friction. The resulting integrally held mass is the reinforced volume.

The facing elements, usually interlocking concrete panels, are not structural members. They serve to retain the soil at the edge of the reinforced soil volume and improve the appearance of the wall. The panels are bolted to the reinforcing strips to keep the facing in place and the entire structure (facing, backfill and reinforcement) behaves as a unit (Figure 2).

The concept of strengthening soil with added rods or fibers is not new. Some birds and animals use the concept in building nests or dens. In Biblical times, attempts were made to improve the quality of adobe brick by adding straw. Roads through swampy areas have been constructed on fill strengthened by small tree trunks and

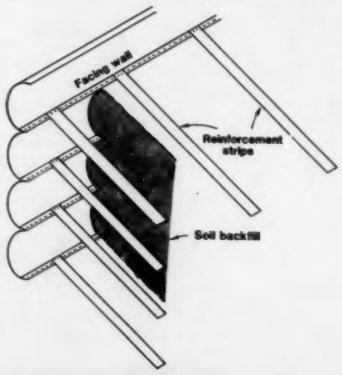


Figure 1. Component parts of reinforced earth.

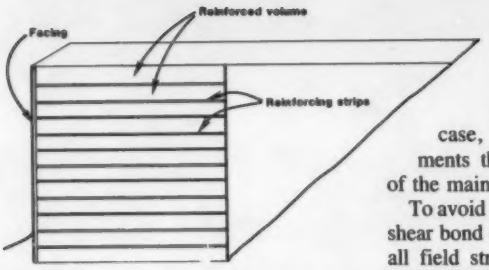


Figure 2. Reinforced earth structure.

branches, called corduroy roads. Seventeenth and eighteenth century French settlers reclaimed rich farm land along the Canadian Bay of Fundy by constructing dikes of mud and sticks. The Maritime Marshlands Reclamation Authority has used this same dike construction technique often since the 1930s.

Henri Vidal, a French architect-engineer, developed the use of reinforced earth for use in important (large scale) engineered structures. He conducted a simple experiment to demonstrate the beneficial effects of adding a small amount of fibrous material to soil. Figure 4 shows a stress-strain curve obtained from a triaxial test on sand containing a small amount of wood shavings compared to a similar test without the shavings. This elementary type of reinforcing increased the strength of the specimen more than four times.

Like reinforced concrete, the beneficial effects depend on a combination of tensile strength of the reinforcement and the shear bond with the surrounding soil. In each case, the reinforcement supplements the weaker tensile strength of the main material.

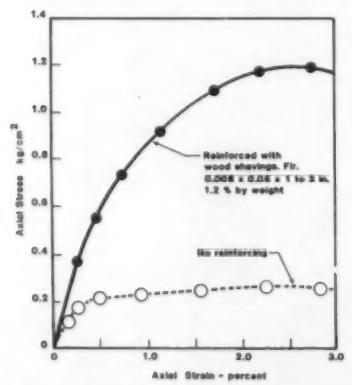

Axial Stress - kg/cm²
Axial Strain - percent
Reinforced with wood shavings. Fir. 0.008 x 0.08 x 1 to 3 in. 1.2 % by weight
No reinforcing

Figure 3. Effect of adding reinforcing to sand.

To avoid dealing with poor frictional shear bond effects, most lab work and all field structures have utilized free draining cohesionless backfill such as sand. However, the basic concepts should apply to cohesive soils (i.e., clays and silts) and studies to determine earth pressure and bond strength characteristics may soon permit their use also.

COMPARATIVE COST ANALYSIS

With reinforced earth, as with most types of constuction, the key criterion for success is to do the required job for the least cost. Advantages of one construction material versus another are indicated by relative costs of construction resources: money, labor, material, and time.

A comparative cost analysis was undertaken comparing construction costs of reinforced concrete, metal bin and reinforced earth retaining walls under ideal simple conditions. The walls were considered to be constructed on level pre-prepared foundations with sand backfill rising to a level surface. Reinforced earth requires the backfill to be placed for the length of the reinforcement ties, and this same volume of backfill was considered to be placed for the other wall types.

The most conservative design method (i.e., most costly) was utilized to design the reinforced earth wall. Unit costs were based upon large volume prices. No special allowance was made for the new type of construction.

Costs of metal crib and reinforced concrete cantilever walls were estimated from information obtained from contractors and agencies that build these walls regularly. The results of the comparative cost analysis are summarized to show the estimated cost per running foot versus wall height (Figure 4).

The curves show that, for ideal conditions, reinforced earth walls may be expected to cost about half as much as cantilever or crib walls of similar height. Corrosion resistance of the reinforcement ties was found to be a minor cost item.

TECHNICAL ADVANTAGES

Apart from the cost advantage for the general ideal case, reinforced earth offers several significant technical advantages that make it even more attractive for special situations.

Because it is flexible and the structural components are built simultaneously with the backfill, it will tolerate large differential settlements as in foundations over soft compressible materials (note: bearing capacity failure must be checked also) or large seismic shock forces.

Because reinforced earth walls consist of small prefabricated components and no formwork is required it can be readily adapted to variations of height or shape.

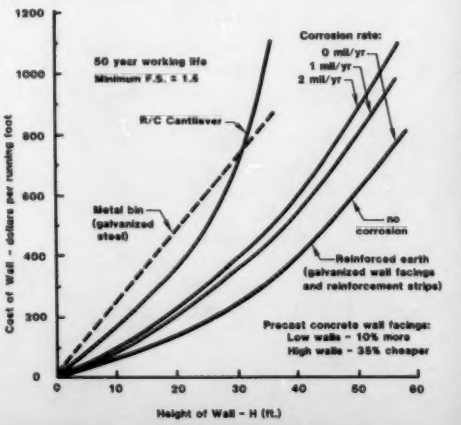
Practical height limit of reinforced earth walls is greater than conventional walls. (In theory, there is no height limit.) In South Africa, the Tweepad Gravity Flow Plant for processing diamond ore has a reinforced earth wall of 41.5 m (136.2 ft) height, which is the highest continuous wall ever constructed.

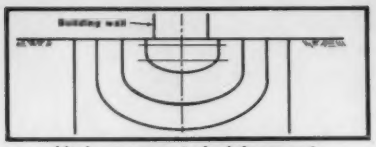
By using precast concrete facings, a wide variety of external designs can be used for different esthetic or architectural effects.

Designs are straightforward and reassuring while not being overly conservative. The concept and design capability is within the understanding and capacity of even small firms. Also, this concept and construction is readily understood and may be conscientiously executed by contractors and/or field inspectors.

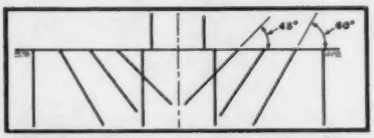
Road/railroad alignments can be significantly improved by the use of reinforced earth in that bridges/tunnels, and excessive grades can often be elim-

Figure 4. Comparative cost estimate for different types of walls (1 mil = 0.025 mm; 1 ft. = 0.305 m).

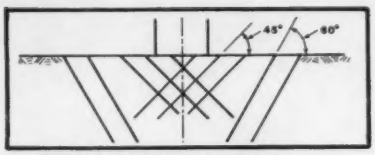

Cost of Wall - dollars per running foot
Height of Wall - H (ft.)
50 year working life
Minimum F.S. = 1.5
Corrosion rate:
0 mil/yr
1 mil/yr
2 mil/yr
R/C Cantilever
Metal bin (galvanized steel)
no corrosion
Reinforced earth (galvanized wall facings and reinforcement strips)
Precast concrete wall facings:
Low walls - 10% more
High walls - 35% cheaper



Ideal arrangement of reinforcement



Practical reinforcement pattern to strenghten existing footing



Practical reinforcement pattern for new construction

Figure 5. Three methods for reinforcing earth beneath foundation walls were tested.

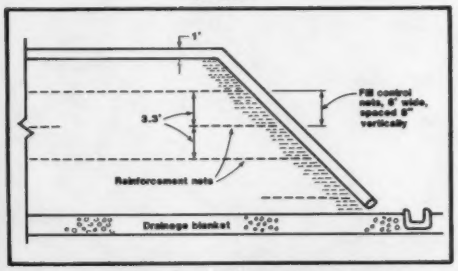


Figure 6. Control nets are recommended at each lift.

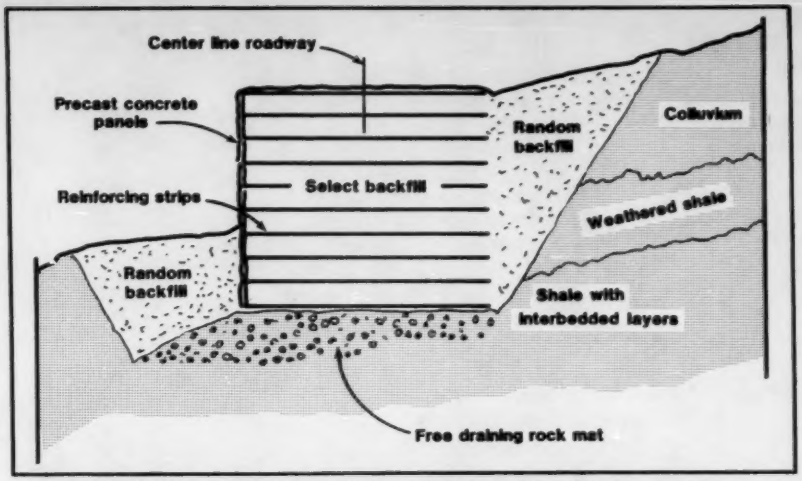


Figure 8. Before correction, this hillside failed in weathered shale zone when water pressure built up. Reinforced earth structure gives toe support to steep hillside.

inated. In remote or mountainous areas costly importation of construction materials is significantly reduced relative to conventional foundation improvement or retaining structure construction.

With bridge abutments, the bridge super-structure rests directly on reinforced earth volume behind the facing so the super-structure bearing seat and the abutment settle as a unit and the "bump at the end of the bridge" is eliminated.

Excellent thermal resistivity permits utilization of reinforced earth for containment dikes of Liquid Natural Gas or for foundation improvement beneath LNG tanks or other cold storage facilities.

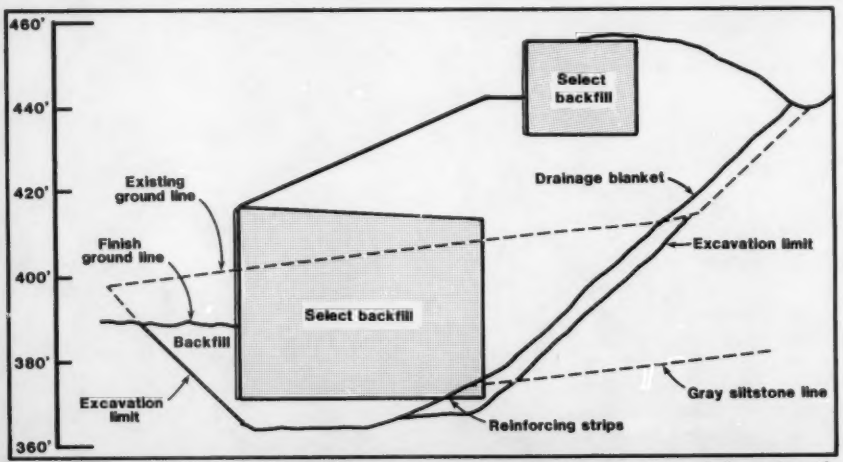


Figure 7. A massive side-hill fill failure was corrected by using two reinforced earth structures. The bottom reinforced earth structure acts as a buttress for embankment support and the top one serves as the roadway support.

Ease and speed of construction are of great significance. Time and labor required are substantially less and the labor is not that of skilled tradesmen. One contractor working along Interstate 80 in Idaho constructed 3800 ft of retaining wall in one day.

APPLICATIONS AND CASE HISTORIES

The economies of resources and suitability of reinforced earth have expanded to match the needs of constructors/designers. Below are some examples:

- Sprain Brook Parkway, Elmsford, New Jersey. A three-mile extension of four-lane parkway involved four reinforced earth structures (abutments and retaining walls) that cost about 50% (more than $1 million) less than conventional reinforced concrete structures. The rate of construction averaged 930 ft. per work day.
- Coal storage facilities owned by Thunder Basin Coal Co. and Kerr-McKee Coal Co. Sloping-faced, slot-bottomed coal-storage "slots" permit automated conveyor deposit and reclamation from storage with gravity flow of the coal. Again, reinforced earth was selected for flexibility and economy of construction.
- Foundation reinforcement beneath footings and embankments increase bearing capacity. Sinkholes in limestone have been bridged over with flexible reinforced earth slabs saving about 25% of cost and 60% construction time relative to conventional alternatives. Excavation is reduced and the results are safe and sure while other

structural and/or stabilizer alternatives are not as certain remedies. Small diameter rods or tubes driven at angles caused the bearing capacity of sand to double the in-situ unreinforced strength (Figure 5).

- Grids can be used to reinforce soil increase strength even more than the bars or strips developed by Henri Vidal. In-situ bearing capacity will increase about three-fold and repeated load resistance also increases greatly. These factors are critical in roadwork.

Ordinary # 3 reinforcing bars were fabricated into 6″ × 24″ meshes 15′ in length and used instead of the Reinforced Earth Co. reinforcing strips for a retaining wall. This system developed passive soil pressures in addition to the friction resistance between the mesh and soil to achieve strengths seven times greater than conventional reinforced earth construction. Another variation is to use waste product tire side-walls connected by reinforcing bar clips to form grid mats for soil reinforcement. The donut-shaped tire sidewalls are very strong in tension and will not corrode.

Such mats can be placed in soil at 2-ft. intervals and a steep 1/2 horiz.: 1 vert. side slope without wall facing panels will be stable (normally slopes are 1.5:1 or 2:1). Significant earth hauling and placing can be eliminated and/or lower quality backfill materials can be utilized with any of the grid reinforcement systems. As a fringe benefit landfills may not have as much troublesome tire material to "digest" if tires can be recycled as soil reinforcement.

- Fabrics and nets can be used to reinforce soil masses also. When geotextiles replace metal strips as reinforcement, the length of embedment (and excavation required) is substantially decreased since the fabric area is relatively greater (Figure 6). Long-term creep characteristics of geotextiles are yet to be determined so large dead-load applications must, for the present, be avoided. Fabric may be used to act as reinforcement and facing also in reinforced earth construction. This technique is particularly well suited to remote, expedient, or short term construction. The only material and equipment required is the geotextile fabric and a bulldozer to construct a servicable road in steep terrain without skilled labor except for the equipment operator.

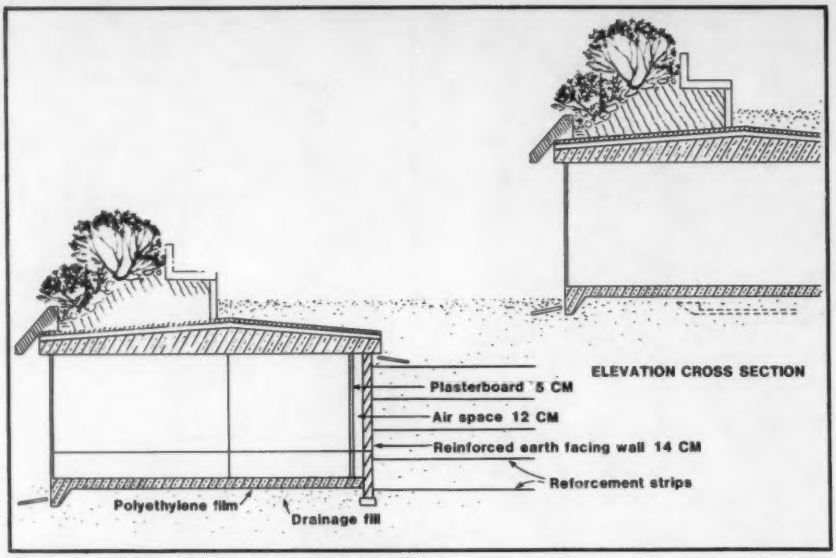


Figure 9a. Theoretical cross section of a home.

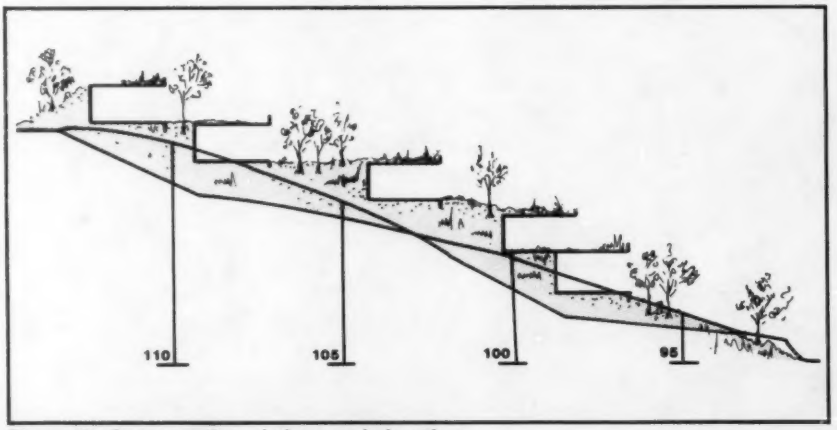


Figure 9b. Cross section of slope and elevation.

Railway embankments in Japan are often reinforced with synthetic resin nets to increase resistance to earthquakes, volcanic activity, and soil softening due to high rainfalls during typhoons. Narrow 6 ft. wide "fill control nets" are placed at 8 in. intervals along the side slope of the embankment and "reinforcement nets" are placed to greater embedment lengths at 3 ft. to 4 ft. vertical intervals. The result is a more densely compacted embankment with far greater structural strength and resistance to erosion, which requires little maintenance.

Continued on page 26

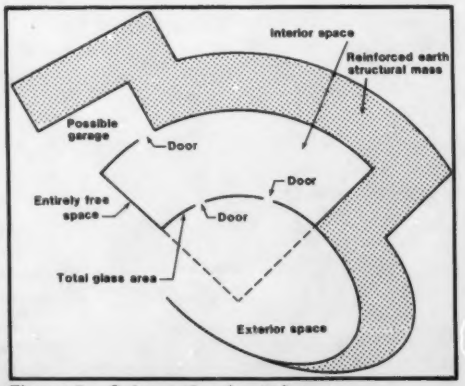


Figure 9c. Schematic of one home.

Retired CEC officer visits old battle station at 'Pearl'

By JEANNE A. LIGHT
Public Affairs Officer
PacDiv, NAVFAC

The memories came flooding back for a retired Civil Engineer Corps (CEC) officer as he stood on the site of his old battle station at Pearl Harbor. Here he was again, some 40 years after the attack, remembering the events of so long ago.

Lieutenant Commander Joseph F. Fitzpatrick, CEC, USNR (Retired), noted this was a different Hawaii. But for a split second, standing on the grounds so full of history, he was transported back to the time when Hawaii's paradise soon turned into a living nightmare.

At the time of the attack, then Lieutenant Junior Grade Fitzpatrick was a reservist on active duty with the 14th Naval District, Public Works Office Headquarters. On the morning of December 7, 1941, he and two young CEC officers were among the first to report after the attack began. "I was sent on an emergency basis to report to the Captain of the Yard for the purpose of directing the flooding of Number 1 drydock to float the battleship Pennsylvania," he said.

In order to maintain visual contact with the Captain's office, Fitzpatrick positioned himself on the caisson of the drydock. Though he was relieved from the position later that afternoon, he remained on duty at Pearl Harbor until Christmas Day. "That was my first day off since the attack," he said.

Retired Civil Engineer Corps LtCdr. Joseph Fitzpatrick (right) shows his fiancee Dorothy Judd (center) and her daughter Virginia the general direction of the former hospital located at Hospital Point.

For 10 days to two weeks afterwards, he and those stationed with him waited for another strike. "Rumors persisted that an invasion force was ready to strike again, but of course that never happened," he said.

On his first visit to the islands since he was stationed here during the war, Fitzpatrick called on the Navy's top CEC officer in the Pacific, Rear Admiral Howard H. Haynes, Commander, Pacific Division, Naval Facilities Engineering Command.

Now, thanks to the Admiral, he was back at the scene, reliving the memories of that day and those that followed. Through special arrangements made with the shipyard security office, he was escorted to the site of his old battle station, accompanied by his fiance, Dorothy Judd and her daughter, Virginia.

Much of what he saw on the tour was new to him. "All this is unfamiliar," he said, "I don't remember any of it." Later, he stood on Hospital Point and recalled, "I spent about a week in the hospital which once stood over there," he told his guests, pointing in the general direction of the former hospital.

His face lit up brightly when he saw the front of the Shipyard Administration building. "My old office used to be in this building. I was afraid it might have been torn down and replaced by a new one. But I can tell it's the same one. They've added a third floor, but it's the same building," he said.

His fiancee noted they've watched all the movies made of the attack referring to "Tora, Tora, Tora," and others based around Pearl Harbor, hoping to find a landmark or building that Fitzpatrick would recognize. "Somehow, visiting here and actually seeing Pearl Harbor makes it all seem so real," she said. "It was more like a dream before, but now it's very real."

They also were planning to visit the Arizona Memorial where Dorothy said she would find the name of a friend's son, who died on board the Arizona in that attack.

After only one day in Hawaii, Fitzpatrick said he was overwhelmed at the changes. "I knew there had been major developments here, but I can't get over how close together the high-rises are in Waikiki," he said.

He produced a photograph taken of him in front of his apartment building in Waikiki on the Sunday preceding the Pearl Harbor attack. "That would make it November 30, 1941," he said. "And I believe this building was located on the lot where the Hilton Hawaiian Village now stands."

He was also impressed with the expansion of the Navy facilities. "Just by what I've seen, I'd say the Navy area is 10 times greater than what it was in 1941."

Fitzpatrick made hotel accommodations at the Royal Hawaiian Hotel because it tied in with the trip. "I remember when the Navy used the Royal Hawaiian Hotel as a rest and recuperation facility for the submarine crew. I was involved with checking to make sure it would accommodate the men, so I thought that would be the best place for us to stay," he said.

Following the Pearl Harbor attack, Fitzpatrick continued in new construction and damage repair until March 1942 when he was ordered to the Naval Air Station, Palmyra Island as Resident Officer in Charge of Construction (ROICC) and Public Works Officer (PWO).

From March 1943 to March 1944, he was assistant project manager of the Outlying Island Bases. He served as ROICC/PWO Naval Air Station, Klamath Falls, Oregon, from July 1944 until his release to inactive duty in November 1946.

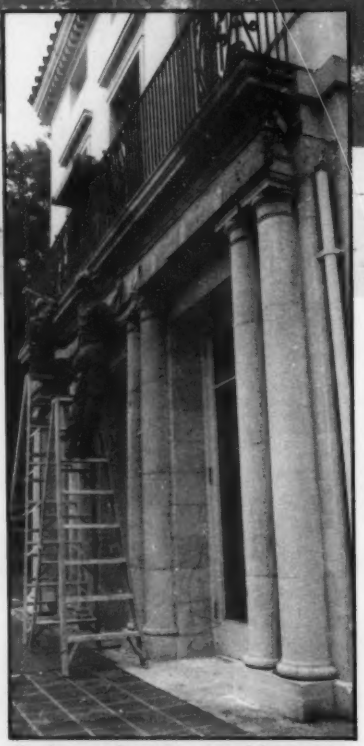
Fitzpatrick, who now resides in Salem, Oregon, lives on a street called Pali Drive, named, of course, for the Pali here in Hawaii. □

Bard Mansion preserved for future generations

STORY AND MODERN PHOTOS BY BEN DUFFY

For nearly 40 years the commanding officers of what is now the Naval Construction Battalion Center at Port Hueneme, Calif., have been the custodians of a distinctive and, in some ways, unique part of California's history. Now, under the direction of Dr. Mike Yachnis, Chief Engineer of the Naval Facilities Engineering Command (NAVFACENGCOM) and with the help and resources of others in NAVFACENGCOM, the Center's public works department, architects, engineers, and Seabee volunteers, a part of the Civil Engineer Corps history, as well as a part of America's past, will be preserved for future generations.

For many CEC officers who passed through the Center on their way to the Pacific during World War II, Korea, and Vietnam, perhaps no other memory of Port Hueneme is as indelible as that of the red-tiled roofed Bard Mansion, surrounded by park-like grounds, which served as the Center's Officers' Club. On a warm summer evening, with the jasmine in bloom, a stroll through the grove of more than 75 species of ornamental trees and shrubs brought from exotic countries only dreamed of, are echoes from a less hurried time.



Seabees take down an old canopy addition from the CBC Officers' Club to restore the mansion's facade to the original design.

The Bard Mansion, called Berylwood by the Bard family, served as a Bachelor Officer Quarters and Officers' Club from the time the Navy acquired the nearly 63-acre estate in 1944. Later, the mansion was converted to use solely as an officers' club and served as such until the mansion was closed in January 1980.

The mansion was closed to public use by Center officials because the old house did not meet California State building code requirements for earthquake resistance.

HISTORICAL BACKGROUND

The early beginning of the Bard estate, as well as the Naval Construction Battalion Center, has its origin in an 1837 Mexican land grant for the area then known as the Rancho El Rio de Santa Clara o'la Colonia. The area of the grant encompassed nearly 45,000 acres — an area of almost 70 square miles of fertile river valley and rolling

The selection of Hueneme, as the sleepy coastal village was then known, to be as the site of Thomas Bard's home was made in 1871 with the construction of a wharf on his property. The completion of this wharf was the beginning of the Port of Hueneme. As shipping increased through the port he created,

Port Hueneme became the second largest port on the California coast for the shipment of grain.

The present Bard Mansion was built in 1911, Thomas had returned to California only six years earlier having served as Senator from California from 1900-05. Although he would live in Berylwood, named for his youngest daughter, only three years before his death in 1915, Mrs. Bard Continued to use the mansion as a summer residence until her death in 1937. The house remained vacant for seven years until Navy occupancy in 1944.

THE NAVY TAKES OVER

When the Navy moved into the Bard mansion the house had fallen into disrepair, but the basic structure was sound. The mansion itself was a three-story woodframe structure with brick veneer walls and an exterior plaster and concrete facade. It rested on a partial foundation with reinforced concrete vaults, and had a passenger elevator connecting the main floor of the house with the upper floor and attic.

The mansion's white-washed exterior and Spanish-style red-tiled roof lent a stately appearance to the house. Twelve bedrooms, seven full baths, four one-half baths with indoor plumbing, and 17,000 square feet of floor area attest to the Bard's desire to build a home in keeping with the Senator's position in the development of Ventura County.

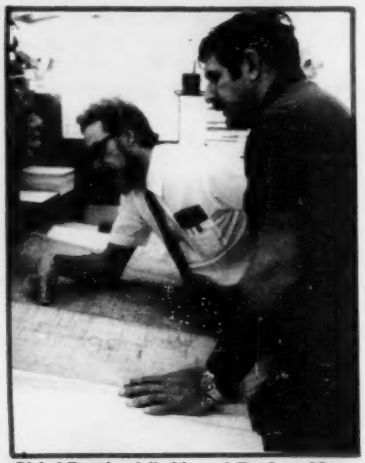
Since the Navy's acquisition of the Bard estate, the principal building alterations consisted of enclosing the north porch of the house for a private dining room in 1951, enclosure of the south terrace for a cocktail room and lounge in 1962, and removal of the original elevator and various interior room partitions to increase the usable floor space. Other additions include a dining room and storage area, and kitchen galley with storage area.

RENOVATION BEGINS

The Bard mansion sat virtually unused from January 1980. In October 1981, Dr. Mike Yachnis, Chief Engineer of NAVFACENGCOM, was asked whether he could "find an affordable means to alter the mansion to withstand earthquake forces." The brilliant Dr. Yachnis and his competent staff developed a solution that was practical and affordable.

CBC public works personnel, principally Mr. Joe Lopez, Chief Engineer and architect Mr. Hugh O'Connell then worked with Dr. Yachnis and his staff in the development of a detailed design for altering and repairing the mansion. Public works architect O'Connell was designated as project manager.

Although there were no significant problems in tackling the project, there were some minor irritations. "Some of the problems we ran into while strengthening the structure were finding that the interior walls were not square, and that they were out of plumb due to the settling of the building. In addition, rafters and ceilings were also out of plumb due to settlement," said O'Connell. "Most of the work done the Bard house was simple carpentry."



Chief Bottiggi (left) and Project Manager Hugh O'Connell, architect, go over the original drawings of the 72-year-old house.

From a structural standpoint the building was much sounder than had originally been expected. The Bard mansion is of double-stud construction. Two layers of studs are covered with a brick and plaster veneer. What surprised architect O'Connell was the condition of the original exterior brick walls. "One of the things we discovered," he said, "when we checked the original brick, was the excellent shape the brick was in. The foundation concrete is as durable and solid as anything we have today."

There were still a few more surprises for the architect once the original plaster and lath was removed.

"Some of the things the carpenter incorporated into the original structure I thought they had no understanding about at that time. When they installed the second-floor joists they put in a king post truss made with steel channels and tie rods to restrict deflection of the floor. Normally, when something sags under its own weight it's called deflection. The original builders removed this potential for deflection by creating a king post truss. It was a surprising find because it didn't show on the original drawing," O'Connell said.

Strengthening the structure included anchoring the building to its foundation wall by installing steel plates tied to the basement wall with wedge anchors and lag bolts to prevent the building from sliding from its foundation in the event of severe earth movement.

The materials needed for structural alteration and improvements to the building were approximately $83,000 according to public works officials.

Joe Lopez, Public Works Engineering Director, described the two major areas for upgrading the structure. "There were architectural and structural problems we had to overcome in the Bard house project. Both Hugh O'Connell and I worked on the problem and awarded a contract to a firm to study the structure. The study showed, with certain improvements, it would meet building codes thus continuing Dr. Yachnis' initial analysis. We also tested the existing masonry to determine whether it could withstand a horizontal load stress, as would occur in the event of earth movement," he said.

By hydraulic compression testing of the original brick the amount of stress needed to rupture the joints was determined. This test proved that the building's masonry would withstand the stress imposed upon it by an earthquake using California State standards. "Knowing this," said Lopez, "we tied the wooden frame to the masonry around the perimeter of the building."

The renovation of the Bard mansion has taken slightly more than two years to complete. A 25-man Seabee work crew, with project volunteers rotating among the homeported battalions and the Thirty-First Naval Construction Regiment in Port Hueneme, were under the direction and professional guidance of Builder Chief D.E. Botteggi.

Interior modifications to the building included installing plywood shear panels to add to the total "stiffness" of the structure. The original building system, according to Lopez, was excellent

Windows and door openings in the El Rey Room were bricked to reduce building sway in the event of a tremor. The brick openings were then stuccoed and pipe columns were placed to support original colonades.

Seabees lay tongue and groove 3/4" plywood over concrete floor in the mansion's West Room.

In the completed West Meeting Room, shear panels and sheet rock were added to walls after old plaster, lathe and electrical wiring was removed.

The building was tied to its foundation by 8"×16"×3/8" plate using wedge anchors and lag bolts.

On a warm evening, a stroll through the park-like grounds brings echoes of a "less hurried time"

for withstanding vertical loads, but lacked lateral support to resist earthquake forces. These shear walls now act as vertical diaphragms and connect the ground floor, second story floor, and attic with the brick perimeter walls of the building. Tubular steel frames were installed in the original south wall to resist lateral forces in addition to the existing masonry wall. These frames tie the structure together and anchor it to the foundation.

Architects and engineers from the Naval Facilities Engineering Command worked closely with Center architects and engineers, and reviewed the proposed structural drawings before actual construction got underway.

When the decisions on the structural design had been reached and the final drawings completed, the Seabees moved in to begin the actual construction. Seabee Project Supervisor BUC Botteggi was enthusiastic about the final outcome of the project. According to Botteggi the project was one of the most challenging he has tackled in his 17 years with the 'Bees.

"When we were tasked with this project," he said, "the Seabee work crews were excited by the challenge of actually working on the house. This type of project is something we don't often encounter as Seabees."

Seabee steelworkers and construction electricians aided the public works crews in rewiring portions of the structure, and performed the routine carpentry work required. The tubular steel framing was installed by public works personnel while the Seabees were installing the steel anchor plates to the foundation of the building.

"It was a good experience for the Seabees to be working side-by-side with public works professionals," said Botteggi. "The cooperation the public works civilians showed our work crews was exceptional. They showed the less experienced Seabees more effective ways of tackling particular problems," he said.

The interior work to the main floor of the building included the placing and pouring of a concrete base for the original columnade support footings, installing I-beam support and footings, and shoring as needed for extra strength. In addition, more than 300 plywood shear panels were installed. Brick and stucco were used to close window, door, and cavity wall openings in the original masonry, no longer needed to ensure additional structural strength.

Three and one-half-inch steel tubing sections were extended from the ground floor to the attic as a main frame brace for lateral resistance. Horizontal strength was added by providing joist connector rods to the second floor and attic horizontal diaphragms. Shear panels were vertically blocked and anchored to the south wall shear frames. These were then covered with 3/8" plywood and covered with gypsum board.

Second floor improvements included the placing of a concrete subfloor for insulation and sound proofing in areas to be used primarily for office areas. The subfloor was covered with three-quarter inch tongue and groove plywood and covered with particle board.

Attic work was primarily plywood flooring connected to the completed bolt and blocked shear wall framing and panels. Existing interior masonry walls were strengthened and the area around the original elevator shaft was framed and strengthened. It was a challenge met and bested by professionals.

When refinishing of the interior of the historic Bard mansion is completed early in 1984 and opens its doors once again to a new generation of Civil Engineer Corps Officers, it will be a showplace. A reminder to all who walk its heavily wooded grounds, the Bard Estate will serve as a bright example of what can be achieved when respect for tradition, an eye for detail, professional pride, and a "Can Do" spirit of cooperation are applied to a formidable task.

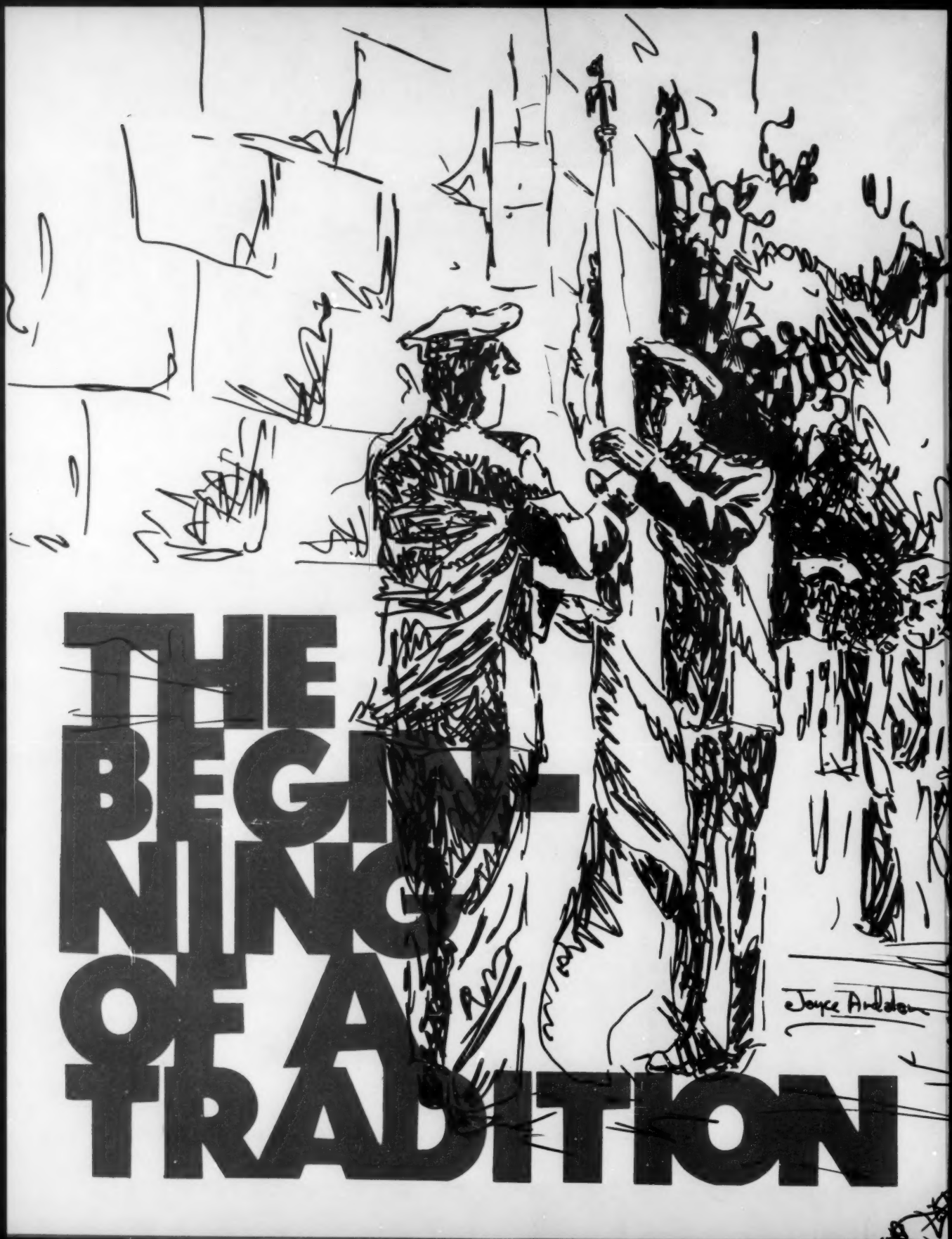
Once again the Bard estate will take its rightful place as perhaps the most remembered landmark in all of southern California by past and present CEC officers who visit the Naval Construction Battalion Center, Port Hueneme. □

ENGINEERING AND DESIGN CRITERIA - The Command's efforts to develop and update engineering and design criteria were strengthened during FY83, principally by a major delegation of criteria work to the field. By the end of FY84, 95 percent of approximately 3,000 engineering and design documents comprising specifications, design manuals, P-Publications and definitive/standard designs will have been delegated to the field. The purpose of this delegation is to ensure that high quality state-of-the art criteria will continue to be provided on an updated schedule that best supports the fleet. It has been recognized by OSD and CNO that "up-to-date" technical guidance is essential in all mission elements, including facilities engineering and design. Consequently, a five-year update cycle has been established as a critical goal--no individual document shall exceed five years of age. Achievement of the goal will require a substantial improvement over past criteria update cycles, which ranged from more than 10 years to the present cycle of over seven years. Annual criteria investments averaging five million dollars during FY80 through FY84 will be exceeded by a projected investment of nearly eight million dollars in FY85. In perspective, with the investment in facilities construction programmed for nearly two billion dollars for FY85, the cost of engineering and design criteria in FY85 will represent less than half of one percent of the construction/modernization investment.

(NAVFAC Code 04)

BATTLESHIP SURFACE ACTION GROUP - The Navy has recently selected Staten Island as the preferred homeport for a Battleship Surface Action Group (BB SAG). Homeported in Staten Island will be a battleship, cruiser, destroyer, two guided missile destroyers, two reserve frigates and more than 3,700 Navy personnel. Waterfront facilities will be at a location known as Stapleton. Personnel support facilities will be located about a mile from Stapleton at the former Army Base, Fort Wadsworth. Family housing will be provided primarily by the local economy. The Battleship and Cruiser of the SAG are expected to arrive at Staten Island in late 1988. The rest of the ships should arrive in mid 1989. This selection ended a year long homeport search of the Northeast by an OPNAV Study Group consisting of representatives from CINCLANTFLT, Northern Division and NAVFAC Headquarters. Other locations considered for homeporting were Boston and Narragansett Bay, R.I.

(NAVFAC Code 2012)


THE BEGIN-
NING OF A
TRADITION
Joyce Audeen

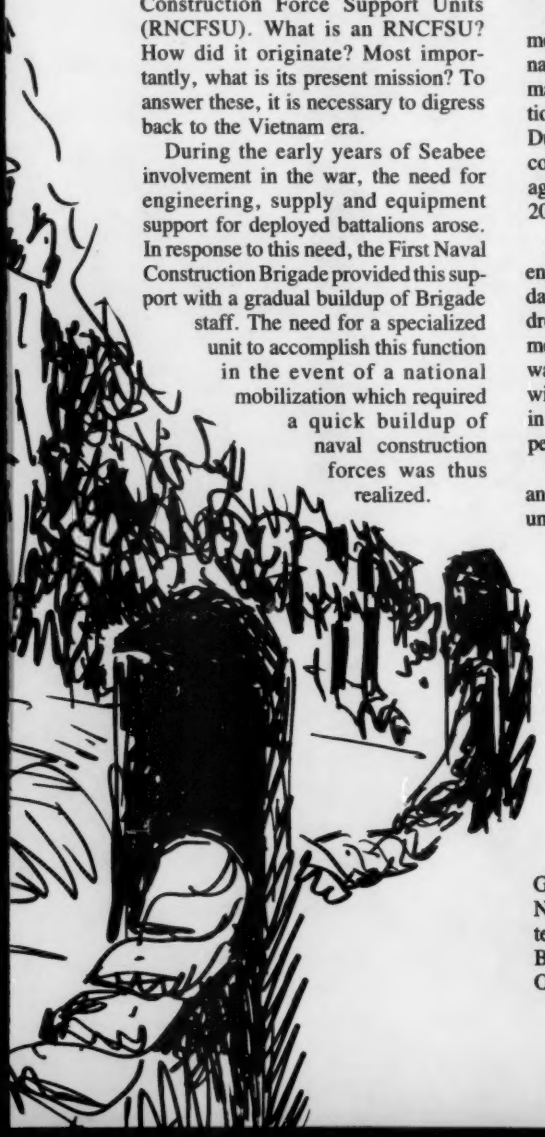
'I am ready to assume command'

By LT RAYMOND K. ALEXANDER, CEC, USNR-R
P. E., Tenn.
Equipment Officer, RNCFSU-1

On a clear, warm October afternoon at the TRIAD Reserve Center in Greensboro, N.C., the adjutant calls the unit of three companies to attention. The parade order is read and unit colors are presented to the prospective commanding officer. Finally, those traditional words which have been a part of the U.S. Navy since its inception, are spoken. "I am ready to assume command." The formal establishment and assumption of command of Reserve Naval Construction Force Support Unit ONE is accomplished and in a matter of minutes another Navy tradition begins.

Three pertinent questions surround the establishment of the Reserve Naval Construction Force Support Units (RNCFSU). What is an RNCFSU? How did it originate? Most importantly, what is its present mission? To answer these, it is necessary to digress back to the Vietnam era.

During the early years of Seabee involvement in the war, the need for engineering, supply and equipment support for deployed battalions arose. In response to this need, the First Naval Construction Brigade provided this support with a gradual buildup of Brigade staff. The need for a specialized unit to accomplish this function in the event of a national mobilization which required a quick buildup of naval construction forces was thus realized.



The concept of such a unit began with two officers, 27 men, and 100 pieces of equipment which would augment the staff of deployed Naval Construction Regiments (NCR). As the number of deployed battalions increased, this support concept expanded to include five officers, 68 men and 150 pieces of augmented equipment attached directly to the brigade.

Its primary mission included equipment control and intermediate maintenance, specialized repair and overhaul, materials management, and construction plant and long haul operations. During the final years of the war, the concept evolved and expanded once again to include twelve officers and 202 men.

Its mission was modified to include engineering services and automated data processing, and at the same time, dropping the plant operations requirement. During this time, no official unit was established because NCF, along with the rest of our armed forces, was in a transition from a war time to a peace time environment.

Until the late 1970's, the unit size and written concept remained virtually unchanged. However, early in 1978, as a result of the Navy Manpower Mobility System Study (NAMMOS), the concept of support units was approved by the Joint Chiefs of Staff or incorporation to selected Reserve Units. Two such units were authorized by the CNO on July 30, 1981 and established on October 1, 1981.

The first unit was to be headquartered at the TRIAD Armed Forces Reserve Center, Greensboro, N.C., and second at the Naval and Marine Corps Reserve Center, Denver, Co. Their mission: "To Be Mobilization Ready to Provide Operational Construction Logistic Support to a Deployed Naval Construction Regiment of up to four Construction Battalions."

This means there are now two organized ready reserve units each ready to perform the following tasks in support of up to one NCR and four NMCBs:

- Operate local and long-haul transportation equipment in support of NCF units; Perform organizational and intermediate maintenance and repair for supported units; Repair equipment assemblies and sub-assemblies such as transmissions, engines, generators, and motors.
- Act as custodian of and maintain inventory control for special NCF augment equipment (concrete/asphalt batch plants, rock crushers, etc.) while issuing this specialized augment equipment to NMCB's.
- Provide supervisory/technical personnel in support of NMCB's to facilitate operation and maintenance of special NCF augment equipment required for rock production, asphalt plant production, well drilling, soil stabilization, electrical transmission line installation, heavy timber construction and concrete plant production.
- Perform inventory management of construction materials as well as those for advanced base functional components (ABFC), requisition, expediting, receipt, control, issue, delivery, retrograding, and other supply functions for supported NCF units.
- Provide facility planning design, estimating, and engineering services required for NMCB's to execute construction projects.
- Provide and operate limited Automated Data Processing (ADP) service in support of NCFSU's and NCR's.

In order to accomplish the mission, the organization of an RNCFSU was originally set up based on an NMCB with modifications to meet specific needs of the unit. Included in the unit was the traditional CO (CDR), XO (LCDR), S-1 (LTJG), S-2 (LT), S-3 (LCDR), and S-4 (LCDR, SC).

In addition to this staff, an Equipment Department headed by a LCDR CEC officer was added in order to handle inventory, transfer and supervision of the operation of all augment equipment to other NCF units. This

'Each day, new concepts arise . . .'

department, although separate, worked in conjunction with the unit's 'A' company.

The unit's three companies were then organized along the established lines of 'H' company comprising of all the executive staffs, 'A' company was the equipment company with its EO's and CM's, while 'B' company, traditionally the utilities company, combined all vertical construction rates.

It must be noted that a Support Unit is not required nor expected to maintain a vertical construction capability, but rather to provide technical support and training for the NMCB's.

In February 1983, after a long and careful review of the mission and requirements of an NCFSU (designated P31), NAVFAC issued a general revision and reorganization of the P31. The new organization provided for a more efficient use of manpower in carrying out the equipment, engineering, and logistical support role of the unit.

This new structure does away with the traditional S-1, S-2, S-3, S-4, A company and B company concepts and replaces them with four major departments: Administrative Services, Equipment Management, Engineering Support, and Logistics as shown in the NCFSU Organization Chart.

The Administrative Services Department now operates under the PASS office concept which provides clerical, medical, subsistence, berthing, personnel record management, and disbursing services while working with the attached NCR. In addition, the department is charged with unit security and communications during a war time environment.

The Equipment Department is headed by the Equipment Officer (LCDR, CEC) and is organized into three distinct divisions. The Equipment Operations division, led by an EQCM, is responsible for local and long haul transportation and equipment recycling. The Equipment Maintenance division, led by a CEC LT, operates the automotive and construction equipment, automotive electric and battery, lubrication rack and tire repair, motor and generator repair, and transmission and engine overhaul shops. The third division of the department is the Technical Support and Augment Equipment Assignment division (LTJG, CEC). Its responsibility lies with coordinating and providing other NCF units with augment equipment assignment, equipment maintenance coordination, and technical equipment support in the assembling and operation of major construction plant equipment (concrete/asphalt batch plants, rock crushers, etc.).

During the conflict in Vietnam, there arose a need for engineering, supply and equipment support for deployed battalions. The First Naval Construction Brigade provided this support with a gradual buildup of brigade staff.

The Engineering Support Department is headed by a CEC LCDR and provides supported units with additional engineering/design support. During a war time scenario, the Engineering Support Officer also acts as the Unit's Operations Officer by directing all military evolutions.

The department is divided into two divisions with two sections each. The Assistant Engineering Support Officer (LT, CEC) is in charge of the Surveying and Soils Analysis/Material Testing sections, while the Design Officer (LTJG, CEC) is responsible for the Design and Planning/Estimating sections.

The fourth and final department in a Support Unit is the Logistics Department. This is normally run by a Supply Corps LCDR and is organized into two divisions. The Fiscal Officer (LT, SC) heads up the Supply and Consumables, Materials expediter, Repair Parts, and ADP Sections.

The Material Liaison Officer (MLO) is responsible for the efficient operation of the MLO yard for the regiment to which the unit is attached. Normally a CWO3, the MLO is to provide a central receiving point for incoming materials for deployed units of the assigned regiment and then to supply those units upon request.

The next concern is to get the manpower and to get started. In order to establish the first of these units, four detachments from RCMCB 24 were transferred to the command of RNCFSU-1 on October 1, 1981. These detachments, however, still remained under the administrative control of the battalion.

One year was given to the new command and staff of the Support Unit to organize, plan for ACDUTRA, and become capable of self sufficient command. Thus, for the first year of its inception, RNMCB 24 became a "Big Brother" to the young unit.

By the time of its establishment, RNCFSU-1 had been through one unit ACDUTRA at Gulfport, Miss., and had accomplished its goal of being a self-sufficient command. Since then, RNCFSU-1 has been on a continual climb to be ready to accomplish its mission if ever called upon. This has been done through careful planning and training.

Military training, provided by the Infantry Training School, Camp Lejeune, N.C., taught each man basic survival, defensive tactics, and general NBC protective measures. The two weeks of training culminated in a two-day FEX in which each man and every level of command (fire team, platoon, company, and department) including the command staff, was tested in simulated battlefield conditions.

The following year, the unit carried out operational training by sending 35 men to Guantanamo Bay, Cuba, for OJT on the operation of concrete and asphalt batch plants as well as rock crushing/quarry operations. The remainder of the unit obtained training by assuming control of and operating the 20th RNCR equipment yard in Gulfport for 3RD RNCR units.

RNCFSU-1 is a newly defined organization with a specialized mission for a versatile construction force. Each day, new concepts arise, requirements are identified, and training developed, all building a new tradition. □

One method for construction monitoring/control

By Lt. Gerald T. Frentz, CEC, USN
EIT, Pa.

A principal job function of nearly all civil engineers, civilian or military, at some point in their career, is the monitoring and control of maintenance or construction project workloads. Within the NAVFAC family, the workloads commonly thought of include military and fiscal year construction programs, individual or group contracts, and specific maintenance or construction projects.

For cost-reimbursable contracts, the NAVFAC P-398 instructs that the "primary efforts or functions concerned with control at the contract level involve workload analysis, resource balancing, financial control, and evaluation of the contractor's performance."

These four elements apply to much more than just the cost-reimbursable contract, or even lump-sum contracts. Any work effort and expenditure of resources managed by civil engineers must be controlled through these elements. One method developed and used to accomplish such control with the aid of a WANG Word Processor, standard throughout NAVFAC, is presented. The principles contained herein, however, may be applied to and used on any computational/information system.

Workload analysis reviews and evaluates the parameters or constraints inherent in the effort, and the work force's capabilities in terms of material, equipment and labor skills. According to P-398, the "evaluation considers progress, current and potential workload, contractor plans and schedules, and financial limitations . . .Workload 'planning and scheduling' is one of the major keys to the evaluation."

Very probably, the most widely used parameter is some form of Work-In-Place (WIP) plan and measurement system. Such a system portrays quantity usage over a period of time. All too often, however, the system chosen requires a "quantity surveyor" to painstakingly inspect and record the percentage of effort put forth on the project.

Through careful initial selection of work elements to be accomplished, much time can be saved if the quantities can be easily measured, and agreed to, by the inspector and the worker or contractor. An example of this kind of element breakdown is shown on the "WIP form" in Figure 1.

Elements are assigned from the precedence or logic network for the project. They are quantified and defined on paper to allow easy recognition of accomplishment. An example for a typical personnel housing project might be Finish Electrical, with the unit quantity being one room's worth of light fixtures, switches, outlets, etc., and the total quantity being the number of rooms in the structure to be done.

Once these elements are entered on the form, they are time-phased by applying start, duration, and end weeks in numeric form and the defined quantity to be accomplished at 100% completion of the element. The elements are then weighted to provide an accurate combined percentage com-

```
10  GROUND SUPPORT EQUIP SHOP                                   WORK IN PLACE REPORT FORM - DOC 2836Z - Page 11
LAST PERIOD  THIS PERIOD     ESTD. COST    LINE ITEM PERCENT     L/I    CONTRACT
YY.MMDD CWK  YY.MMDD CWK  SCHEDULE "A"  LAST + THIS = TOTAL X  WGT  =  WIP %
83.0521  97  83.0528  98      760,000    95.55   0.18   95.73  0.0027    0.26396

  C T I     20 AUG START RUN END  38  26  64   UNIT TOT  UNI   DEC % ELM  L/I DEC ! LI SKED A Y WK DELAY  TST  WND FIRE     ASSET I !
  G Y N     CURRNT START RUN END  42  57  99   MEAS UNI  IPL   IN PL WGT  % IN PL !    ($K) N MA EQ MN  SKD  REP PROT     TOTAL D !
01 2 A M PREPS FOUNDATION          41   3  44   BAY    5    5  1.000  15  0.15000 ! 10    760     !
02 2 C M U/G PLUMB                 43   2  45   EA     1    1  1.000   8  0.08000 ! 10    760     !
03 2 B M U/G ELECT                 43   2  45   EA     1    1  1.000   6  0.06000 ! 10    760     !
04 2 A M SLAB ON GRADE             44   4  48   BAY    6    6  1.000   5  0.05000 ! 10    760     !
05 2 A M ERECT PEB FRAME           49   1  50   BAY    5    5  1.000   5  0.05000 ! 10    760     !
06 2 A M METAL ROOF                50   1  51   EA     1    1  1.000   2  0.02000 ! 10    760     !
07 2 A M CMU WALLS                 50  16  66   BAY    5    5  1.000   4  0.04000 ! 10    760     !
08 2 C M PLUMBING                  53  17  70   EA     1    1  1.000   2  0.02000 ! 10    760     !
09 2 A M SIDING                    55  11  66   EA     1    1  1.000   2  0.02000 ! 10    760     !
10 2 B M A/G ELECT ROUGH IN        61   8  69   EA     1    1  1.000   8  0.08000 ! 10    760     !
11 1 C E 6000# MRAIL HOIST&TRLEY   70   1  71   EA     1    1  1.000   1  0.01000 ! 10    760     !
12 2 C M SPRINKLER SYS             71   3  74   EA     1    1  1.000   2  0.02000 ! 10    760          93   93   93          #!
13 1 C M ANCILLARY EQUIP           74  15  89   EA     3    3  1.000   2  0.02000 ! 10    760     !
14 1 C M COMPRESSORS               79   1  80   EA     2    2  1.000   2  0.02000 ! 10    760     !
15 2 A M BLDG FINISHES             80  12  92   RM     6    6  1.000   4  0.04000 ! 10    760     !
16 2 B M A/G ELECT F&F             81  12  93   RM     6    6  1.000   5  0.05000 ! 10    760     !
17 2 B M FIRE ALARM SYS            82   9  91   EA     1    1  1.000   1  0.01000 ! 10    760          93   93   93          #!
18 2 C M HVAC                      85   8  93   SYS    6    6  1.000   8  0.08000 ! 10    760          93                       !
19 1 A M RCP CULVERT & HDWLLS      85   4  89   EA     4    4  1.000   7  0.07000 ! 10    760 N   !
20 1 B M SECURITY LIGHTING         85   4  89   EA     1    1  1.000   2  0.02000 ! 10    760 N   !
21 1 A M ASPH. PAV'T & BASE CRS    87  10  97   EA     1    1  1.000   3  0.03000 ! 10    760 N                                ¶!
22 1 A M DRAIN DITCH & PAV'T       92   6  98   EA     3    0  0.000   2  0.00000 ! 10    760 N                                ¶!
23 1 A M CONSTRUCT FENCE           94   5  99   EA     1         0.000   1  0.00000 ! 10    760 N   !
24 1 B E CHECK OUT & TEST          94   5  99   EA     8    2  0.250   1  0.00250 ! 10    760     !
25 1 A M PUNCHLIST                 91   8  99   %    100  #74  0.740   2  0.01480 ! 10    760     !
AA       UTILITY TIE IN & TEST     88   9  96                                     ! 10    760     !
BB       DOICC START RUN BOD       42  56  98                                     ! 10    760     !

     RHRM
         CONTINUED PUNCHLIST ITEMS
         CONTINUED WORK ON DRAINAGE DITCHES AND PAVEMENT

     NOTE:
         SEE MICRO WIP (LOCATED IMMEDIATELY FOLLOWING THE "WIP SUMMARY") FOR ACTIVITY
         ELEMENT #25 "PUNCHLIST" BACK-UP.
```

Figure 1.

plete for the project. This elemental weighting can be made from the planning estimates of the labor or equipment usage requirements, or from any breakdown that seems rational and totals to 100%.

When a measurable portion of the element is done, such as five of 50 rooms, the number of units complete is entered and calculations made to show what percentage that is of the element and the weighted percentage of the project.

For managing multiple projects, or line items, within a given program or contract, the top of the form can be used to show the line item's dollar value. When compared to the total contract, the percentage of work accomplished by completion of a particular element, multiplied by the line item's value as a percent of the contract, yields the contribution to total WIP for the contract.

To visually represent the completed form as a set of cumulative percentages over time, a series of logic steps can be performed which compare duration, total units to be done, and elemental weights. This comparison and calculation will yield a distribution of the weights over weekly periods corresponding to a well balanced method of accomplishment of the elements.

To keep the number of entries on a particular line item's form manageable, the use of more detailed breakdowns of specific elements can be made through a "micro-WIP." An example might be the entry called "Punchlist" which typically involves multiple crafts and work activities needed to complete the last few percentage points of the project.

The unit of measure on the general WIP form is percent. As the micro-WIP progress is calculated through the normal method of counting completed measurable units defined in advance, the micro percentage value is applied to the general WIP form and thus donates its portion of WIP to the line item's overall completion.

From this set of start/finish weeks, elemental weights and quantities, a schedule by week of the projected percent complete for each item may be calculated and loaded into a column on a "data set" or spread sheet for comparison with the proposed progress of other line items. These plans can then be analyzed individually and easily adjusted to meet critical milestones or Beneficial Occupancy Dates (BODs).

When each line item's percent complete in a given week is multiplied by the dollar value of its contribution to the program or contract, and divided by the total dollars in that contract, the weighted percentage contribution of WIP to that contract is obtained.

Measurement against the plan can now be accomplished, and an evaluation of contractor performance is made easier by establishing this baseline for progress of the individual projects, group programs and the contract as a whole.

Resource balancing is the second function to be accomplished by the Engineer/Manager. It "involves an appraisal of available funds and workload, to determine the optimum allowable outlays for labor, materials, equipment, subcontracts, and other expense categories."

The WIP form shown allows for the entry of these various resources.

The second, third, and fourth columns provide coded indications as to the construction group or kind of work to be done, the type of labor or subcontractor to be used, and the intensity area of the work: equipment or manpower.

The columns on the right of the forms provide special constraints like the week in which a vendor representative is to visit the job, fire protection inspections, or system tests will be accomplished.

The last two columns depict quantities of limited assets to be used on that element such as cubic yards of concrete, tons of asphalt, tarpots, or paving machines.

With these assets loaded, graphic examples of the contractor's use of a particular item can be produced. The bars of

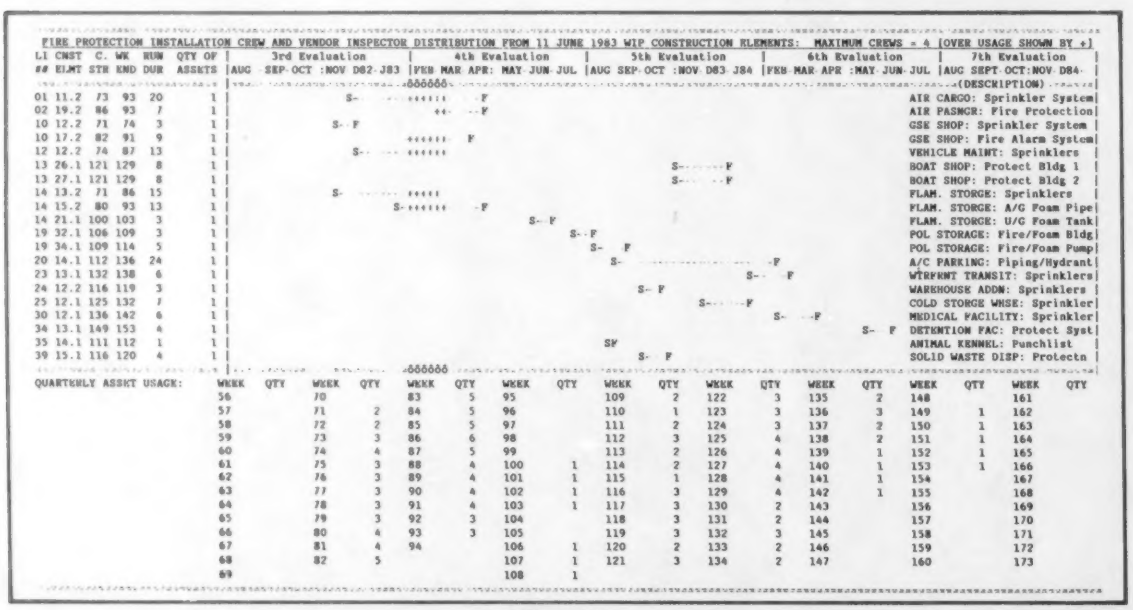

FIRE PROTECTION INSTALLATION CREW AND VENDOR INSPECTOR DISTRIBUTION FROM 11 JUNE 1983 WIP CONSTRUCTION ELEMENTS: MAXIMUM CREWS = 4 [OVER USAGE SHOWN BY +]
LI CNST C. WK NUM QTY OF | 3rd Evaluation | 4th Evaluation | 5th Evaluation | 6th Evaluation | 7th Evaluation |
ELMT STR END DUR ASSETS |AUG SEP OCT :NOV DEC JAN |FEB MAR APR: MAY JUN JUL |AUG SEP OCT :NOV DEC JAN |FEB MAR APR :MAY JUN JUL |AUG SEPT OCT:NOV DEC | (DESCRIPTION)
01 11.2 73 93 20 1 AIR CARGO: Sprinkler System
02 19.2 86 93 7 1 AIR PASNGR: Fire Protection
10 12.2 71 74 3 1 GSE SHOP: Sprinkler System
10 17.2 82 91 9 1 GSE SHOP: Fire Alarm System
12 12.2 74 87 13 1 VEHICLE MAINT: Sprinklers
13 26.1 121 129 8 1 BOAT SHOP: Protect Bldg 1
13 27.1 121 129 8 1 BOAT SHOP: Protect Bldg 2
14 13.2 71 86 15 1 FLAM. STORGE: Sprinklers
14 15.2 80 93 13 1 FLAM. STORGE: A/G Foam Pipe
14 21.1 100 103 3 1 FLAM. STORGE: U/G Foam Tank
19 32.1 106 109 3 1 POL STORAGE: Fire/Foam Bldg
19 34.1 109 114 5 1 POL STORAGE: Fire/Foam Pump
20 14.1 112 136 24 1 A/C PARKING: Piping/Hydrant
23 13.1 132 138 6 1 WTRFRNT TRANSIT: Sprinklers
24 12.2 116 119 3 1 WAREHOUSE ADDN: Sprinklers
25 12.1 125 132 7 1 COLD STORGE WHSE: Sprinkler
30 12.1 136 142 6 1 MEDICAL FACILITY: Sprinkler
34 13.1 149 153 4 1 DETENTION FAC: Protect Syst
35 14.1 111 112 1 1 ANIMAL KENNEL: Punchlist
39 15.1 116 120 4 1 SOLID WASTE DISP: Protectn
QUARTERLY ASSET USAGE:
WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY WEEK QTY
56 70 83 5 95 109 2 122 3 135 2 148 161
57 71 2 84 5 96 110 1 123 3 136 3 149 1 162
58 72 2 85 5 97 111 2 124 3 137 2 150 1 163
59 73 3 86 6 98 112 3 125 4 138 2 151 1 164
60 74 4 87 5 99 113 2 126 4 139 1 152 1 165
61 75 3 88 4 100 1 114 2 127 4 140 1 153 1 166
62 76 3 89 4 101 1 115 1 128 4 141 1 154 167
63 77 3 90 4 102 1 116 3 129 4 142 1 155 168
64 78 3 91 4 103 1 117 3 130 2 143 156 169
65 79 3 92 3 104 118 3 131 2 144 157 170
66 80 4 93 3 105 119 3 132 3 145 158 171
67 81 4 94 106 1 120 2 133 2 146 159 172
68 82 5 107 1 121 3 134 2 147 160 173
69 108 1

Figure 2.

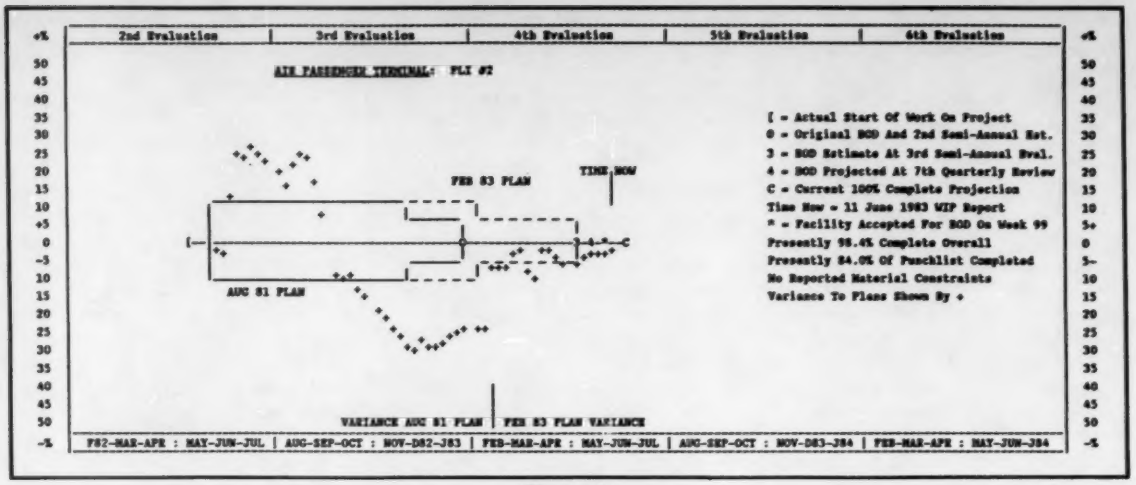

2nd Evaluation
3rd Evaluation
4th Evaluation
5th Evaluation
6th Evaluation
AIR PASSENGER TERMINAL: PLT #2
FEB 83 PLAN
TIME NOW
AUG 81 PLAN
VARIANCE AUG 81 PLAN
FEB 83 PLAN VARIANCE
A = Actual Start Of Work On Project
B = Original BOD And 2nd Semi-Annual Est.
3 = BOD Estimate At 3rd Semi-Annual Eval.
4 = BOD Projected At 7th Quarterly Review
C = Current 100% Complete Projection
Time Now = 11 June 1983 WIP Report
* = Facility Accepted For BOD On Week 99
Presently 98.4% Complete Overall
Presently 84.0% Of Punchlist Completed
No Reported Material Constraints
Variance To Plans Shown By +
FEB-MAR-APR : MAY-JUN-JUL | AUG-SEP-OCT : NOV-DEC-JAN | FEB-MAR-APR : MAY-JUN-JUL | AUG-SEP-OCT : NOV-DEC-JAN | FEB-MAR-APR : MAY-JUN-JAN

Figure 3.

Figure 2 immediately indicate any potential overutilization of resources, or utilization in a way that may not be an efficient plan or level of effort.

If crew sizes were loaded into the asset column, the maximum numbers, peaks and valleys, of the contractor's labor plan would become apparent and recommendations could be formed to improve the overall position of the contractor and the government's contract administrator.

For financial control, the asset columns can be used to estimate the time-phased flow of a particular activity, such as concrete plant operations, so an accurate commitment forecast of funds for labor and materials may be developed.

Equipment amortization schedules can be formed once the equipment intensive work elements are sorted together and the different pieces of equipment are applied on the durations of the work elements.

The work assigned to the various subcontractors can be sorted together which will provide a time-phased plan for accomplishment of work and thus estimated payments to the subcontractor.

While this simple WIP form is not intended to be used as a "financial" report, its contribution to the overall picture as an easy-to-manipulate data base of work and assets, as noted in the examples above, can be very helpful.

The final control function to be considered is evaluation of the contractor's performance. This evaluation "in areas relating to costs, accuracy of estimates, production rates, validity of schedules, work force balance, use of assets and other facets of the total operations, is required to improve overall planning and control, and to determine award fee ratings if applicable." Two major indicators of performance are productivity and the meeting of BODs.

For productivity, the measurement of WIP slippage or gain each month is "a good indication as to whether work generally is being accomplished on time, or is lagging. It also provides a good measure of whether the work is being performed on those jobs for which resources have been scheduled, or on other jobs." The data set developed from the original submittal of WIP forms would represent the baseline plan.

As work is reported complete each week, the weighted actual WIP is loaded into a companion data set. If the contractor reevaluates his original plan and changes the WIP form dates or elements, a current proposal is run from the new forms.

The three columns of numbers can be graphically portrayed in the classic "S-curve" style, with the distance between the curves showing how far ahead or behind the contractor's productivity is. This distance can also be shown as a variance to the original plan.

If an envelope of acceptable performance is established and agreed to by the contractor, his acutal performance and current plan might appear as in Figure 3.

BODs, and progress towards meeting them, or the need for adjusting them, is visible here. "Since BODs are of primary concern to OICC program managers and sponsors, the results of these evaluations should be presented to them . . . thereby keeping them abreast of the reasons for slippage, when they occur, and the status of the program as a whole." Having the original or target BODs at the top of the WIP forms keeps them continually before the evaluators and estimators who work with the forms.

Also, it is apparent to the contractor who enters the agreed upon units complete on the forms that the government is concerned about these milestones and wants to know if slippages will be occurring.

Some of the word processing glossary programs that generate the WIP forms, the calculated data sets, the resource bar-charts and the graphic displays have already been passed to some of the independent OICCs, the Reserve Naval OICC Southern Europe, Naval Construction Training Center, Gulfport, and two of the Engineering Field Divisions.

In conclusion, this system of monitoring the Work-In-Place has been used successfully by the OICC Diego Garcia to provide workload analysis, resource balancing, financial control, and evaluation of contractor performance.

So far the system has proven itself to be a very valuable tool in managing multiple program contracts, monitoring performance on over 50 line items, and providing accurate and timely resource allocation information upon which recommendations for corrective action have been made. □

reader's comments/questions

departments

One more word about baseball error

You blew it when you edited the article on Omaha in your Spring '83 edition.

The Kansas City Royals play *major* league baseball, but do not play in Omaha. All of their regular season — American League — home games are played in Kansas City, Missouri.

However, the Ohama Royals (a class AA farm club of the Kansas City Royals) *do* play outstanding minor league baseball in Omaha, Nebraska.

Surely, even Californians have heard of our George Brett and his "pine-tarred bat"!

Capt. Bernard L. Hansen,
USN (Ret)
Kansas City, Mo.

Thank you for your letter, Captain, and for your interest. We stand corrected.

Reader unhappy with our style and format

I have watched with dismay the trend in recent issues towards articles spotlighting personalities instead of engineering topics. The front page teasers read like the National Enquirer: "Women in CEC at all-time high: Five recent recruits tell why." Is this an expose on cocaine? "They are going to have to kick me out, says this Navy man." Confessions of a gay sailor? Alas, the stories are more mundane than that.

I enjoy swapping stories with my fellow officers in the wardroom, but must I read about their vacation on camels and how-they-joined-the-Navy in my engineering journal? I inter-service transferred from the Army seven years ago, but hardly considered it newsworthy.

It is the fault of the journalist and the editor (and not the subject of the feature article) when four pages of autobiographical quotes and five photos are devoted to one officer. This does little to serve the principle of *esprit de corps*.

Granted there are achievements deserving recognition in the Navy Civil Engineer. But what I have observed is an obsession with daily routine: No officer should be made the subject of a time-and-motion study, much less be forced to read it.

If the problem is a lack of juicy engineering manuscripts, I confess I am part of the problem. If so, I pledge two manuscripts in the next twelve months. If my peers follow suit, the editor should have some good fare to serve the readership. If not, we'll all soon need publicity agents instead of detailers to manage our careers.

LCdr. Neil B. Hall,
CEC, USN
Okinawa

Thank you for writing, for your interest, and especially for your candor because it allows me an opportunity to explain my editorial motives.

I'm sorry that the human-interest, non-technical articles were so distasteful to you. You're entitled to your opinion, of course, and I'm happy that you spoke out. I do respect your opinion. You're a reader and the magazine really belongs to you. It's my job to please as many readers as possible. I only hope there aren't many out there who think as you do. If there are, perhaps your letter will cause them to write as you did.

I try to keep a 30/70 per cent balance of material in the magazine. That's 30 per cent human interest articles — articles about people, careers, interesting places, etc. — and 70 per cent technical articles. I believe that engineers are people too and as such, like to read about people and their experiences and sometimes their problems. As an editor, I want people to pick up the magazine and read it. Human interest articles and covers cause them to do that. But my opinion isn't the only one that guides me in my selection of articles.

Just when I began to believe the 30/70 idea was all mine, I discovered it was already spelled out for me in the formal instructions that guide me in my job. I am supposed to publish human interest articles, along with technical articles.

Also, The Navy Civil Engineer magazine is used by the Naval Recruiting Command and the CEC Collegiate Program Officers as a valued recruiting aid. I understand it is now their principal recruiting aid. According to the findings of the Editorial Review Board for FY 1980, "This recruiting value was a strong factor in CHINFO's approval of a multi-colored cover for the magazine."

It might interest you to know that the article about LCdr. Ernest R. Hunter was done at the suggestion of Navy recruiters to implement a current recruiting program. The article about the number of women being at an all time "high" in the CEC was also done to aid recruiters in attracting college students into the CEC.

If enough readers feel as you do — of course we'll do everything in our power to change — to make the magazine exactly what the readership demands. After all, if we lose the readers — we've lost the battle and we're not doing our job.

Thank you for writing and please write again if you have any more to say on this subject. And by the way . . . your first article is due soon. Are you thinking of that?

What does an editor do? This reader *likes* "human" stories!

Your Summer 1983 issue's article on LCdr. Hunter by JO1 Huesmann is a familiar story. Similarly, I received my draft notice in September 1972 after graduating with a BSCE in June of 1972.

Having had a close acquaintance that was major in the Army, he recommended I apply for the Navy's Civil Engineer Corps Officers program. Unfortunately all quotas had been filled by my reporting date. Subsequently I had the opportunity to serve as an enlisted member of the Seabees as a constructionman engineers aide.

After "earning" a commission with the assistance of a Marine drill instructor, my new bride, and a ketchup bottle (another story) at Aviation Officers School in Pensacola, I spent the next 3½ years in Navy Intelligence. I gained invaluable experience in aviation and fleet operations while assigned to a fighter squadron aboard the aircraft carrier Saratoga.

When RIF'd from the intelligence community due to my reserve status, I regained my composure and applied for a line to staff transfer into the CEC. For the past six years the CEC has rekin-

dled my belief in a naval career. As stated so plainly by LCdr. Hunter they will also have to "kick me out!".

LCdr. Hunter's and my story are not unusual. I have met many CEC officers with similar and interesting stories. You might want to include follow-up stories in your magazine. I enjoyed LCdr. Hunter's story very much. It brought back many memories.

LCdr. Bruce "Hawkeye" Pierce, CEC, USN
NAS Norfolk, Va.

How true, Hawkeye. The trick seems to be in getting those interesting stories into my office. We're working on that! Thanks for writing.

We stand corrected on LCdr. Rigoulot!

In your Summer edition, Mr. Harold Welsh corrected an article printed in the Spring edition "Women in the CEC." In his correction Mr. Welsh stated that LCdr. Jeri M. Rigoulot was the first woman graduate of the U.S. Naval Academy to join the Corps. This is incorrect. The first females graduated from the Naval Academy in May 1980. In that short period of time since graduation Jeri Rigoulot could not have reached the rank of LCdr. Either Mr. Welsh got the rank incorrect of LCdr. Rigoulot is not an academy graduate.

Ensign Geri Dovalgo, USN

Thanks for writing, Geri. Yours was the first of four letters and five phone calls we got concerning this. Read on.

Letters to editor delayed one issue

In August I wrote to comment on your cover story in the Spring 1983 edition of the *Navy Civil Engineer* regarding women in the CEC. Your reference to the individuals as all being engineers was not correct. In fact, two of the women are architects.

In the Summer 1983 edition, no acknowledgement of your mistake was made. Further, in the readers' comments/questions section you printed a letter from Harold Welch, the former editor, in which he referred to LCdr. Jery M. Rigoulot as the "First woman graduate of the U.S. Naval Academy to join the Corps."

I wish to point out that again you are not correct. LCdr. Rigolot is a graduate of the University of Virginia with a degree in architecture. I view your errors as significant and hope you consider it appropriate to confirm this type of information in the future.

LCdr. C. H. Schneider, CEC, USN
NAVFAC, Northern Division

By now, LCdr. Schneider, you have probably learned that your first letter was published in the Fall Issue of the magazine. Unfortunately because of our schedule, letters are usually published two issues later. The reason for that is as follows. Just about the time one issue is distributed, we are "closing the book" on the next issue. For example, as of this writing, November 30, the Fall Issue is due out in about one week. Within three days all material will be at the printer for processing into the Winter Issue. In about one month, letters (if any) will begin to arrive as a result of the Fall Issue. They will have to go in the Spring Issue 1984.

An editor values very highly the letters received from the readership. They provide a two-way communication that is very helpful regardless of whether the tone is negative or positive.

Thank you for both of your letters. Regarding LCdr. Rigoulot, please read on.

More on Rigoulot

Over a 20-year career in the CEC I had the opportunity to deal with Harold Welsh several times and can only say that each time I came away more impressed with his talent. I enjoyed his letter on "first women" in our Corps; however, having had the distinct pleasure of working with Jeri Rigoulot on one of her first assignments (OICC Marianas), I happen to know she was not a graduate of the Academy. As I recall, she went to the University of Virginia and had a degree in architecture. She was on Guam in the 1973-75 time frame and I believe that predates the first women graduates of USNA.

Best wishes for continued success with the Navy Civil Engineer.

Cdr. Gordon W. Callender, Jr., CEC, USN (Ret)
Pensacola, Fla.

PS: PS: Teri was the first woman to join the CEC since World War II.

Reader likes "women in CEC" article

In reference to the "readers' comments/questions" of the Summer 1983 issue, the former editor (ret) bungled it this time! LCdr. Rigoulot is presently the most senior women in the Corps, not an academy graduate, and who's career has been a great model to follow!

Women didn't graduate from the Naval Academy until May 1980, and wouldn't have been promoted to the grade of LCdr., yet.

Got you Mr. Welsh!! This is payback for the practical joke (. . . and it cleared it all up!!) you have paid on many a CECOS class when you were editor.

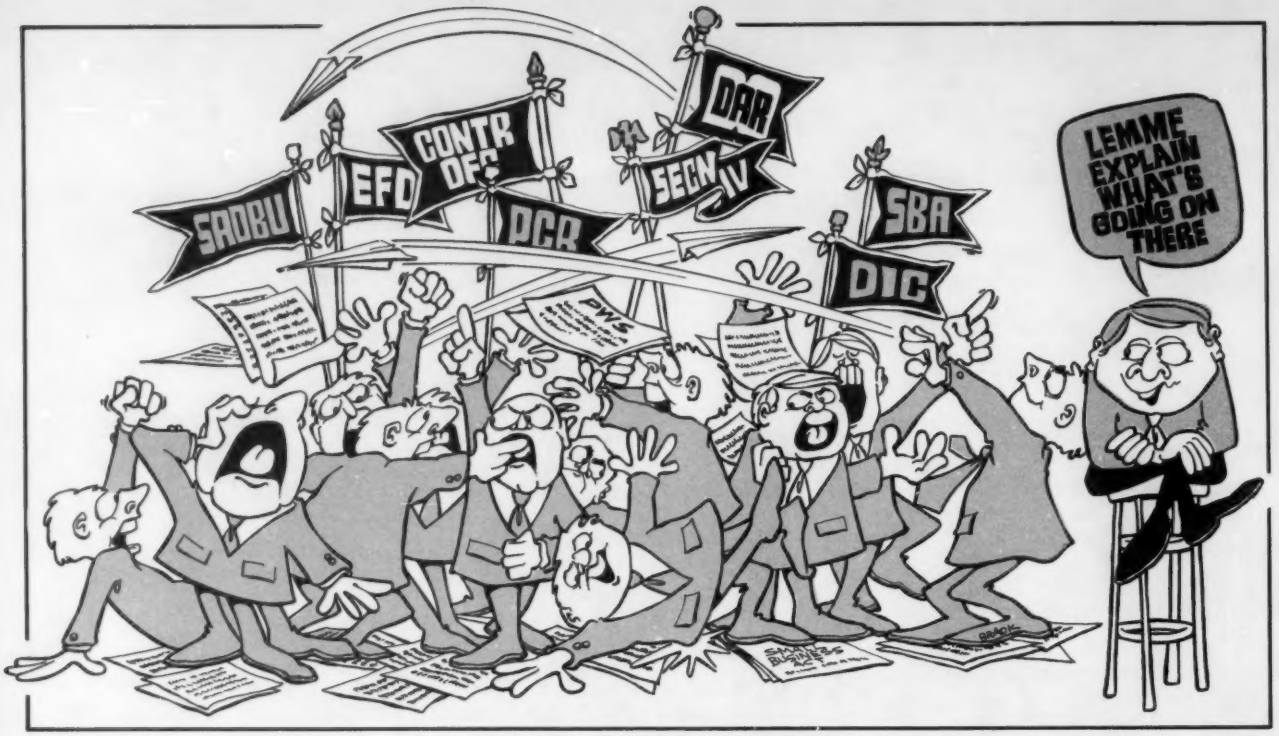
Lt. Connie Meyers Madden, CEC USN
Naval Supply Center
San Diego, Calif.

P.S. I really enjoyed your article about "Women in the CEC." I find many male Navy-types constantly questioning me about CEC careers for their daughters so I give them copies of the article so they can take it home for their daughters to read.

Thanks for straightening us about Rigoulot; for your remarks about the former editor, Harold Welsh; and for liking *the article "Women in the CEC."*

If you need more copies of the "Women" article, please let us know. It may interest you to know that we contacted Mr. Welsh for comment on the Rigoulot error. Know what his reply was? "Pickey, pickey, pickey . . . the first mistake you make in your life and everybody's on your back."

We know Harold is kidding. He's a rascal and a very fine gentleman!



Small business in commercial activities

By Cdr. R.D. KNOWLTON, CEC, USN
P.E., HI
Special Assistant for Commercial Activities and Facilities Support Contracts, NAVFAC

There continues to be conflicting guidance regarding the role of small business in the Commercial Activities (CA) Program. Most of us have been extensively involved with the small business "set-aside" program in non-CA construction contracts and have had very little conflict with the program. As a matter of fact, over 90% of all NAVFAC contract actions are small business "set-asides." However, recently we are finding ourselves more often in situations that seem to be in direct conflict with the small business "set-aside" program.

The increase in conflicts is occurring as a direct result of the recent sharp increase in facilities support contracts caused by the CA Program and a growth in RPMA funding. Many such conflicts are caused by activities trying to abide by the requirements of Section 502 of the Department of Defense Authorization Act 1981 (Public Law No. 96-342 (1980).

The Public Law requires a certification that the government calculation for the cost of performance of a function by Department of Defense personnel is based on the most efficient and cost effective organization (MEO). Commanding officers have, at times, consolidated functions into contract packages that are so large and diverse that they were beyond the capabilities of most small business concerns.

In addition, the apparent success of the BOS contract at Naval Submarine Base, Bangor generated a desire to mirror such success at other activities. More often than not, these packages are of such a large size and diversity that they are not appropriate for the small business "set-aside" program.

Due to the apparent conflicts between efficient packaging versus the small business "set-aside" program, we should take a look at what the Small Business Act really does require. We'll do this by looking at the Defense Acquisition Regulation (DAR) which implements the Department of Defense policy on setting aside contracts for small business.

General Policy

DAR 1-702.(a) states that, "It is the policy of the Department of Defense to place a fair proportion of its total purchases in contracts for supplies, research and development, and services (including contracts for maintenance, repairs and construction), with small business concerns. Every effort should be made to encourage participation by such concerns in the acquisition of supplies and services that are within their capabilities."

The policy goes on to state that, "Small business concerns, both established and potential suppliers, shall be afforded an equitable opportunity to compete for all con-

tracts that they can perform."

Probably the most important provision in the DAR is 1-706.5.(a)(1) which states that, ". . . the entire amount of an individual acquisition or class of acquisition, including contracts for architectural and engineering services, research, development, test and evaluation, maintenance repair, and construction, except small business - small purchase set-asides (1-702(c)), shall be set aside for exclusive small business participation if the contracting officer determines that there is a reasonable expectation that (1) offers will be obtained from at least two responsible small business concerns offering the products of different small business concerns, and (2) awards will be made at reasonable prices. Total set-asides shall not be made unless such a reasonable expectation exists." Given this set of ground rules, let's see how the system works.

The Set-Aside Process

After an activity identifies its requirements (see chart below), the local contracting office makes a determination as to whether or not it is reasonable to expect at least two offers from responsible small business concerns and whether or not the award could be made at a reasonable price. Actually, the appropriate small business size standard is first applied and then the determination of "set-aside" is made. The application of a correct small business size standard (not well understood for facilities support contracts) has a direct bearing on the actual "set-aside" determination.

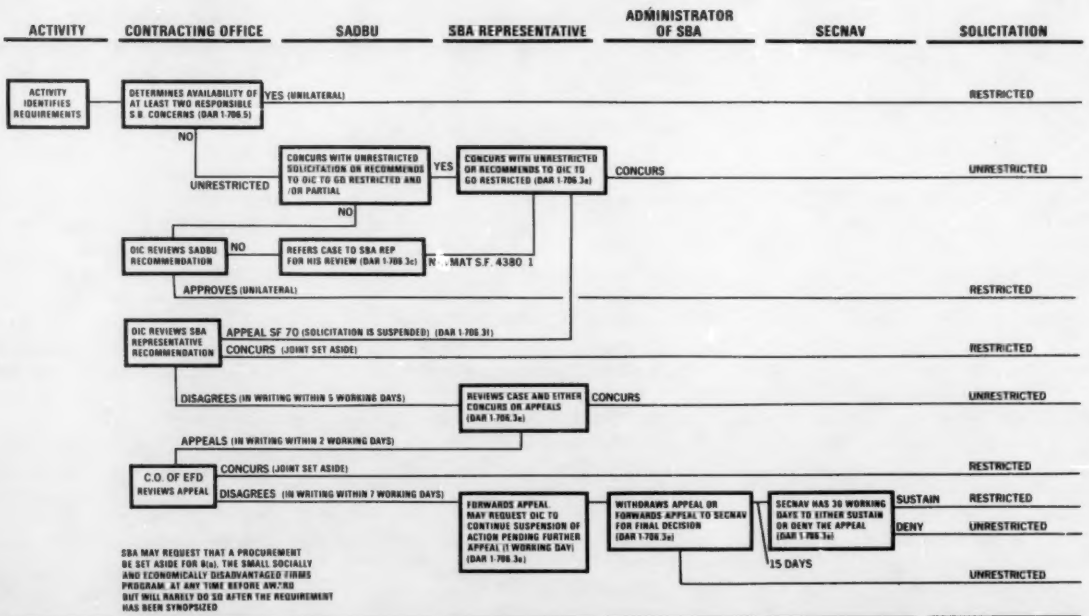
The present small business size standards most commonly used for facilities support contracts vary from a low of $2M to a high of $12M which is the allowable maximum three year average of annual receipts a firm may have in order to be considered a small business. Obviously, the number of qualified bidders at $2M will be substantially less than at $12M.

If the determination is yes, the solicitation is "set-aside" for small business and the local contracting office proceeds with the solicitation. This may not always be true, because most EFDs require review of all facilities support contracts exceeding a certain dollar value. If that is the case the size standard and "set-aside" determination may be concurrently reviewed as discussed below.

A "set-aside" determination by the local contracting office/EFD without SBA's involvement is considered a unilateral determination. If, however, the local contracting office determines that the solicitation should go unrestricted, it notifies the Small and Disadvantaged Business Utilization Specialist (SADBU) at the EFD and provides him with a copy of the solicitation. We will call this Stage 1 of the process.

During the first stage, the SADBU will review the request, he will also study the solicitation to determine if it could be restructured so as to have at least a partial "set-aside." At any time during this stage, the local contracting office may withdraw its request and proceed with a restricted solicitation. If the request is not withdrawn, the SADBU may (a) concur with the request and forward it to the local Small Business Administration (SBA) Procurement Center Representative (PCR), or (b) disagree with the request and send it to the Officer in Charge (OIC) for review. If the OIC does not withdraw the request, the SADBU forwards it to the local PCR with his recommendation for disapproval (in accordance with DAR 1-706.3e).

Review by the local PCR is the second stage of the process. If the PCR agrees with the request, the procurement may be synopsized as an unrestricted acquisition. If the PCR disagrees with the reuest, he issues a Standard Form 70 (SF-70) and the solicitation is suspended for further review (in accordance with DAR 1-706.3f). The OIC must review the PCR's decision. If the OIC agrees with the PCR's determination for a restricted solicitation, no further appeal action is necessary. ⟶


ACTIVITY
CONTRACTING OFFICE
SADBU
SBA REPRESENTATIVE
ADMINISTRATOR OF SBA
SECNAV
SOLICITATION
ACTIVITY IDENTIFIES REQUIREMENTS
DETERMINES AVAILABILITY OF AT LEAST TWO RESPONSIBLE S.B. CONCERNS (DAR 1-706.5)
YES (UNILATERAL)
RESTRICTED
NO
UNRESTRICTED
CONCURS WITH UNRESTRICTED SOLICITATION OR RECOMMENDS TO OIC TO GO RESTRICTED AND /OR PARTIAL
YES
CONCURS WITH UNRESTRICTED OR RECOMMENDS TO OIC TO GO RESTRICTED (DAR 1-706.3e)
CONCURS
UNRESTRICTED
NO
OIC REVIEWS SADBU RECOMMENDATION
NO
REFERS CASE TO SBA REP FOR HIS REVIEW (DAR 1-706.3e)
N . MAT S.F. 4380 1
APPROVES (UNILATERAL)
RESTRICTED
OIC REVIEWS SBA REPRESENTATIVE RECOMMENDATION
APPEAL SF 70 (SOLICITATION IS SUSPENDED) (DAR 1-706.3f)
CONCURS (JOINT SET ASIDE)
RESTRICTED
DISAGREES (IN WRITING WITHIN 5 WORKING DAYS)
REVIEWS CASE AND EITHER CONCURS OR APPEALS (DAR 1-706.3e)
CONCURS
UNRESTRICTED
APPEALS (IN WRITING WITHIN 2 WORKING DAYS)
C.O. OF EFD REVIEWS APPEAL
CONCURS (JOINT SET ASIDE)
RESTRICTED
DISAGREES (IN WRITING WITHIN 7 WORKING DAYS)
FORWARDS APPEAL MAY REQUEST OIC TO CONTINUE SUSPENSION OF ACTION PENDING FURTHER APPEAL (1 WORKING DAY) (DAR 1-706.3e)
WITHDRAWS APPEAL OR FORWARDS APPEAL TO SECNAV FOR FINAL DECISION (DAR 1-706.3e)
SECNAV HAS 30 WORKING DAYS TO EITHER SUSTAIN OR DENY THE APPEAL (DAR 1-706.3e)
SUSTAIN
RESTRICTED
DENY
UNRESTRICTED
15 DAYS
UNRESTRICTED
SBA MAY REQUEST THAT A PROCUREMENT BE SET ASIDE FOR 8(a), THE SMALL SOCIALLY AND ECONOMICALLY DISADVANTAGED FIRMS PROGRAM AT ANY TIME BEFORE AWARD BUT WILL RARELY DO SO AFTER THE REQUIREMENT HAS BEEN SYNOPSIZED

Such a determination with SBA's involvement would be considered a joint "set-aside" determination. The OIC must reply to the PCR in writing within five working days in accordance with DAR 1-706.3e. If the OIC disagrees with the findings of the PCR, the PCR will review the case and may either concur with the OIC or continue the appeal of the OIC's decision. If after reconsideration the PCR determines that the findings of the OIC are appropriate, the solicitation may go unrestricted and no further appeal will be made.

If the PCR does not concur with the OIC's determination, the PCR must send a written appeal within two working days to the Commanding Officer (C.O.) of the Engineering Field Division (EFD) for review. The C.0. of the EFD (acting as the contracting officer for NAVFAC) may now concur with the findings of the PCR and "set aside" the solicitation for exclusive small business participation.

Upon review of the appeal, the C.O. of the EFD may determine that the original decision to go unrestricted is still appropriate and must notify the PCR in writing within seven working days. Upon receipt of such notice, the PCR must indicate to the C.O. of the EFD within one working day his desire to continue the suspension action (SF 70) pending further appeal to higher authority in accordance with DAR 1-706.3e.

In the third stage of the review process, the SBA representative forwards the appeal to the Administrator of the SBA who may choose to withdraw the appeal or forward the appeal to the Secretary of the Navy for final decision in accordance with DAR 1-706.3e. If the Administrator of the SBA agrees with the original unrestricted solicitation decision, the solicitation may go unrestricted. A decision by the Administrator of the SBA to continue the appeal must be forwarded to the Secretary of the Navy within 15 working days.

Review by the Secretary of the Navy is the fourth stage of the review process. The Secretary of the Navy has final decision authority in accordance with DAR 1-706.3e for SBA appeals. Within 30 working days, the Secretary of the Navy must determine to either sustain or deny the SBA's appeal. If he sustains the appeal, the solicitation will go restricted or may be broken up for a partial or total "set-aside." A denial of the appeal by the Secretary will allow the solicitation to go unrestricted.

It is interesting to note that this process involves only the contracting officer, the Small Business Administration, and the Secretary of the Navy.

8(A) Process

The SBA has three ways to approach the 8(A) Program: it contacts the requiring activity and requests that the contract be reserved for appropriate negotiations and recommends a subcontractor; the activity contacts the SBA with the requirement and offers it to the SBA; and the SBA goes directly to the Secretary of the Department and requests that the contract be reserved.

Under Section 8(A) of the Small Business Act (52 USC 637) the SBA is authorized to enter into all types of contracts with other agencies and let subcontracts for performance of those contracts. When acting under the authority of the program, the SBA certifies that is it competent and responsible to perform a specific contract.

The contracting officer shall, at his discretion, negotiate a contract with the SBA based upon mutually agreeable terms and conditions. If the contracting officer and the SBA fail to agree to enter negotiation, the SBA must appeal to the Secretary of the Navy. The Secretary will then convey his decision, in writing, on whether or not the Navy will negotiate under the 8(A) Program, to the SBA.

An advantage with an SBA 8(A) contract is that an activity may initiate negotiations with the SBA and, in fact, may indicate that they have an appropriate requirement for a specific contractor who may have had previous experience with the activity.

Mother earth

Continued from page 10

• Landslide correction with reinforced earth used to rebuild to grade and buttress the toe of the slope is both effective and relatively inexpensive. An excellent case is the repair of Heart of the Hills Road near Port Angeles, Washington. In 1970, a massive slide dropped 200 feet of roadway 30 feet to close the road. Three corrective alternatives were considered:

1. A new embankment with buttresses and berms
2. A bridge structure over the slide area
3. Two reinforced earth walls in a stepped arrangement (Figure 7)

The new embankment with buttresses and berms enlarged the right of way too much, while the bridge was too costly and involved excessive construction time. The reinforced earth solution had none of these disadvantages and also permitted a more aesthetic appearance since the concrete facings blended well with local rock outcroppings. Figure 8 provides another example of landslide correction along I-40 in Tennessee.

• Development of sloping terrain and poor soil areas for residential use is facilitated by reinforced earth. Figure 9 is the plan and sectional elevations of a scheme which provides ample interior space along with a large degree of open space and privacy. High energy efficiency may be achieved in both heating and cooling seasons with earth sheltered housing. Reinforced earth construction may be used both as a structural element of the house (the wall facing), and as the foundation of access roads/driveways or other site adaptions.

CONCLUSION

Research and development has progressed to the stage where designers are producing technically sound, esthetically pleasing, and economical alternatives to more familiar techniques of earth retention structures. Indeed, reinforced earth is often the only feasible solution to construction problems due to its unique properties of thermal resistivity, unlimited height and width, and ability to absorb seismic shock and large differential settlements.

Bottomline economies of 20 to 50% belw alternatives are commmon and the structures are quick and easy to construct. Certainly, the reinforced earth concept and the variety of structures developed from that concept constitute a major advance in civil engineering. □.

news worth reviewing

departments

PWC Subic Bay reveals new support capability

PWC Subic Bay's capability to support the Navy's newest and largest ship was recently established when it successfully met the enormous shore power demands of the nuclear-powered aircraft carrier USS Vinson (CVN-70) during her first in-port period at Subic Bay.

Two 6600 KVA, 4160-volt Mobile Utilities Support Equipment transformers, including high-voltage terminal boxes, secondary lines and dockside outlets were installed at the Leyte carrier wharf at NAS Cubi Point. Over three miles of power cable to connect the wharf to the Subic/Cubi power grid was installed in parallel with existing cables. Capability to provide over 10 million watts of shore power to the ship was achieved.

Sixty-one PWC Utilities Department personnel expended 7,084 manhours on the $345,000-power upgrade project, carried out on an accelerated schedule.

PWC Subic's support of the Vinson was a landmark event in that it was the first 4160-volt cold iron service ever provided to the ship outside the United States. The Vinson's engineering officer presented a ship's plaque to PWC to commemorate the occasion.

Slick, new use for waste oil as fuel in Navy boilers

Twenty to thirty million gallons of waste oils are generated each year by Navy ships, by Navy and Marine Corps bases ashore, and by aircraft facilities. In the past, these waste oils were disposed of by dumping, burning for firefighter training, or contracting with commercial firms for their removal. Now, the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif. has developed use for the waste oils: as a supplemental fuel in Navy boilers.

As the cost of fuel oil for boilers was increasing, the Laboratory began a search for alternative energy resources. One of the more successful research efforts is described in a recently issued report on the "Utilization of Navy-Generated Waste Oils as Boiler Fuel — Handbook of Guidelines and Field Survey Results" (NCEL Technical Note N-1674, August 1983, by T. T. Fu, PhD and C. Semien).

The Handbook provides information for a variety of users at different levels of management and operation. It contains background information on various sources of waste oil, and pertinent information for public works officers and planners.

Readers interested in obtaining a copy of TN-1674 may do so by writting to the Naval Civil Engineering Laboratory, Code L07, Port Hueneme, Calif. 93043.

First Gulfport Seabee Det reunites

The first Seabee battalion assigned to Gulfport, Mississippi was there for only 11 days before deploying to Guadalcanal where they landed on Christmas morning 1942.

Pete Heckman, battalion cook, prepares to cut cake in honor of the 26th Naval Construction Battalion's 41st reunion held aboard the Seabee Center in Gulfport, Miss. The 26th NCB was the first Seabee unit to deploy out of Gulfport in 1942.

Returning to Gulfport for their 41st reunion last fall, the 26th Naval Construction Battalion saw a modern Seabee Center rather than the red clay and chicken wire it was in 1942. There are only a few buildings remaining from their era. "There was no main gate, we just walked through the woods to the beach," said Delmer Wilcox of Waveland, MS.

Meeting each year for the past 41 years has created a treasured bond between these oldtimers. "There were 1,200 of us" said Wilcox. "There is about 300 of us still living and about 100 show up for the reunions." Wilcox, hosting this year's event, was speaking during a reception held in Gulfport in honor of their 41st reunion.

Wilcox said most of the men were between 30 and 45 years old in 1942 and were recruited directly from civilian life on the basis of their construction experience. "They were full of self-confidence — for the Seabees to put their mark on an island meant to transform it from a wilderness into a modern base of operations," he said.

Battalion cook Pete Heakman, Minneapolis, Minn., was called on to cut a cake at the reception. His attempt to make a speech was cut short by good-natured ribbing and shouts of "just cut the cake."

Passive solar systems = long-term savings

According to NCEL's Charles Miles, project engineer, applying passive solar systems to new buildings is one of the most effective and least expensive ways to reduce long-term energy consumption at Naval Shore Activities.

Demonstrating this new technology is NCEL's Environmental Protection Applied Research Laboratory, constructed in 1979. The structure stands 40 feet wide, 100 feet long, and has an 18-foot ceiling. The interior of the building contains a main bay area where several environmental research projects are underway, an enclosed biology lab and a small office.

Tests performed for the Navy by the Los Alamos National Laboratory showed that passive solar energy technology of this type could provide over 80% of the heat needed for New Mexico buildings.

Energy management — heating and power boilers

By STEVE A. WRIGHT
P.E., Fla. and Pa.
NAVFAC HQ

Many of us will agree that the efficient operation of steam and hot water boilers is one of the more important responsibilities of a public works department. When boilers are operated below peak efficiency, fuel costs increase. The additional cost for operating one 20,000 lb/hr steam boiler at 5% below its peak efficiency can be as much as $16,000 per year or more depending on fuel costs, boiler load and other factors. Considering the potential additional fuel costs in this example, it is certainly worth the effort to ensure that boilers are operated near peak efficiency.

Described is a system for monitoring the operating performance of heating and power boilers. In this system, boiler performance reports are prepared by the boiler plant supervisor and forwarded to the activity energy manager each week. The reports are based on routine operating data obtained by the plant operators.

The activity energy manager reviews each report and compares it to previous reports for each boiler. If the performance of a boiler falls below an acceptable threshold, the energy manager requests the plant supervisor to take the necessary steps to return the boiler to an acceptable performance level.

The reporting system is applicable to all boilers which are manned continuously. It is also adaptable to boilers which are not manned continuously.

A boiler performance report is prepared for each operating boiler on a weekly basis. The boiler performance report includes the following information:

- Plot of boiler combustion efficiency versus boiler load
- Plot of the temperature difference between the boiler water and exit gas temperature versus load for steam boilers. Plot of temperature difference between the boiler feedwater and exit gas temperature versus load for hot water generators

Plots of combustion efficiency, and temperature difference versus load should be reported for the full range of operating loads each week. Typical plots are shown below in the sample Boiler Performance Report.

Combustion efficiency can be obtained by direct measurement using a combustion analyzer (cost is about $2,000). Combustion efficiency can also be obtained by measuring boiler intake air temperature, exhaust gas temperature and CO_2 or O_2 and finding the combustion efficiency on charts for the particular fuel being fired.

Combustion Efficiency — Combustion efficiency is a measure of how efficiently the energy in the fuel is being utilized. The optimum combustion efficiencies for the boilers should have been established for each load point when the boiler controls were last tested and adjusted. If measured combustion efficiencies are more than 3% below the optimum combustion efficiencies, corrective active is required. Energy managers probably should not dictate what corrective action should be taken, the type of action required is usually best determined by the plant supervisor. Many factors can cause combustion efficiency to be lower than predicted. Some of these factors are listed below:

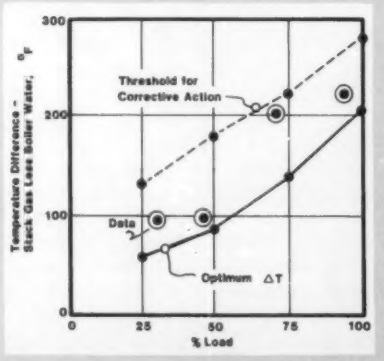
- High excess air
- Fouling of convective surfaces
- Slagging of radiant surfaces
- Scale formation on waterside surfaces
- Poor burner performance
- Fuel quality control

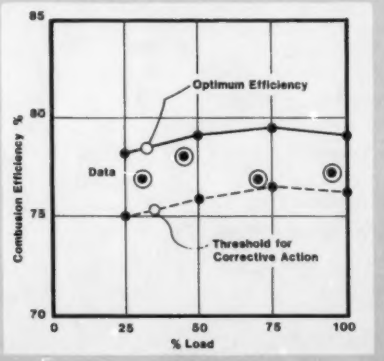
The plant supervisor may require additional funding to correct the problem.

Water and Flue Gas Temperature Difference — This temperature difference is an indicator of the cleanliness of the boiler watersides and firesides. A plot of this temperature difference should be made after the boiler watersides and firesides have been cleaned. If the temperature difference rises by more than 80°F at several load points, deposits have probably formed and should be removed. As a check, combustion efficiency should drop as the temperature difference rises.

The Boiler Performance Report can be an effective tool for monitoring the operating performance of heating and power boilers. The report provides public works management with the information necessary to evaluate boiler performance. If it is determined that boiler performance is not being maintained at the specified level, management can take appropriate action to correct the problem.

During the FY84 heating season, take the time to investigate your boiler operations. Instituting a program to monitor boiler performance such as the one presented here can reduce your annual fuel costs significantly. □





How to locate wasteful electricity usage

Electrical usage is somewhat mysterious since at many activities usage remains high despite the actions taken to reduce consumption. Energy surveys often fail to identify wasteful usage. Incorrect assumptions are made about loads and their effect on total electricity usage, especially for loads that operate outside of normal duty periods or building occupancy hours. Experience shows that a large percentage of the Navy's total usage is in the form of base loads — loads that operate continuously or cycle regularly at all hours of every day and night. At the Naval Civil Engineering Laboratory these base loads were found to include: a large air compressor cycling throughout nonduty hours due to numerous air leaks; energy-intensive environmental equipment with excessive range settings; a pump motor running excessively because a time clock was not properly installed; remote exhaust fans operating continuously; a water heater in a seldom-used facility; and excessive use of after-hours lighting.

The remedies may be as simple as time clocks or changes in manual operating procedures. But unless the load sizes and patterns are identified and understood, the waste will continue. The methods described here are intended to locate wasteful electricity usage.

An electrical load survey is essential to the successful identification of wasteful consumption. Visual surveys and paper studies are positively inadequate. One of the major reasons for performing the load survey is to identify *unexpected* usage levels or patterns. Only by faithful identification and metering of electrical distribution circuits can all of the loads be identified. By following the systematic metering procedure given below, all the loads on the electrical distribution system — either within a building or throughout an entire base — can be traced.

The first step is to obtain the circuit diagrams which show how feeder circuits distribute power to various locations from a main electrical service entrance. Be careful when using old drawings, since many facilities undergo periodic modifications. The same caution applies to old labels on electrical panels and circuit breakers.

If circuits diagrams are lacking or inaccurate, it will be necessary to determine which remote load centers or subdistribution panels are connected to which primary circuit breakers at the main service entrance or transformer. This will require a temporary, controlled shutdown of the electrical system, preferable on a weekend or other nonduty time. Proceed as follows:

- Install a temporary indicator lamp at each load center or subdistribution panel.
- Turn off all primary circuit breakers at main service entrance.
- Verify that all indicator lamps are off.
- Turn on only one primary circuit breaker.
- Observe and record all indicator lamps whether on or off.
- Repeat above two steps for each primary breaker while all others are off.
- Turn on all primary breakers.
- Verify that all indicator lamps are on.
- Use lamp data to make circuit schematic drawing.

Electrical loads and usage patterns are identified by systematically applying meters to various points in the distribution system as follows:

- Make a chart recording of the electrical consumption versus time at the main electrical source or service entrance for a representative weekday and weekend (both Saturday and Sunday).
- Repeat above step for major branch circuits to identify significant loads (especially base loads).
- Selectively monitor lower branch circuits until loads having conservation potential are identified.
- Repeat this process as necessary if daily, weekly, or seasonal load variations are suspected.

Most distribution circuits, except for small loads, are three-phase circuits. It is best to use three-phase recording wattmeters for load surveys since watts are the principal units measured by utilities for billing purposes. A wattmeter indicates instantaneous power demand based on voltage, current, and power factor. Recording meters should be used to obtain a profile of usage versus time. Instantaneous meter readings should be made only with great care since they may miss cycling or intermittent loads. Chart recorders are either built into the wattmeter or available as separate units. Meter installation should be handled by a qualified electrician who is familiar with three-phase wattmeter connections. The installation is somewhat tricky, and wrong connections would cause useless readings.

If wattmeters are unavailable, three-phase recording ammeters are usually adequate alternatives. To determine power levels from current readings requires measurements or estimates of voltage and power factor. Total wattage is the sum of the following product for each phase:

Watts (per phase) = current x voltage (line to neutral) x power factor

Typical power factor values are between 0.8 and 0.95. Single-phase meters can be used if it is determined that loads on the individual phases are approximately equal. Single-phase readings can then be tripled to obtain approximate three-phase values.

In some cases, such as high-voltage circuits, it is difficult to install a wattmeter. Or perhaps no wattmeters are available. In any case, if there is an existing kilowatthour meter (rotating disc type) in a circuit it is possible to obtain some electrical demand information. Kilowatthour meters are normally used by utilities to total the electrical power consumed during a certain billing period (e.g., monthly).

The Navy develops

Offshore bulk fuel systems

Approximately 1,000,000 gallons of fuel a day—offloaded from a tanker moored two miles at sea and delivered by pipeline to shore!

That is the staggering supply the Marine Corps ground and air forces will demand to conduct a successful amphibious landing upon an undeveloped beach.

Since no existing fuel systems offer such logistical capabilities, the Navy is adapting commercial components into its development of the new Offshore Bulk Fuel System (OBFS) designed to satisfy specific Navy/Marine Corps requirements through the 1990's.

As lead laboratory, the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif., has designed an OBFS to be installed and fully operational in 17 days to provide the maximum fuel supply needed. But results from tests at sea reveal that complete installation and full-flow rate can be achieved after 14 days.

The Naval Facilities Engineering Command is the developing agency of the project, and the Strategic Sealift Branch, Chief of Naval Operations, is the sponsor.

NCEL Project Leader Daniel True said the OBFS consists of two Facilities: the Amphibious Assault Fuel Supply Facility (AAFSF) and the Amphibious Tanker Terminal Facility (ATTF). Once amphibious forces have landed with temporary stores of petroleum, oil, lubricants (POL) and emergency supplies, the installation of both facilities gets underway concurrently.

AAFSF provides the short-term capability. Installed within three days, it provides 440,000 gallons of fuel a day. It is operational in sea state 3 with waves up to five feet. ATTF provides reliable off-loading of tankers up to 70,000 dead weight tons in sea state 5 with waves up to 12 feet. Despite these severe offshore conditions, the system is capable of providing 2,000,000 gallons of POL daily, satisfying the long-term, all-weather need of a million gallons a day.

Part of AAFSF, a six-inch buoyant hose, can be installed in four hours from the beach to LSTs moored 5,000 feet offshore. This delivery method provides 300,000 gallons a day initially. AAFSF is completed with the addition of four towable rubber bladders, a mooring, and a transfer pump to shuttle fuel from offshore tankers.

Each bladder is 220 feet long, 11 feet diameter, and holds 110,000 gallons. It is towed by a powered work barge from the tanker to the AAFSF bladder mooring located 2,500 feet off-shore.

Two bladders can be accommodated in this mooring at once. An electric pump, with a switching valve, unloads one bladder while the other, empty one is replaced with a full bladder. POL is carried by the six-inch buoyant hose to shore.

The long-term ATTF, the heart of the OBFS, consists of single point mooring (SPM) fuel buoy to which the tanker moors, high-capacity catenary anchor legs incorporating high-strength chain and four large drag embedment anchors, underbuoy hoses, a pipeline end manifold (PLEM), interconnecting hoses, and two 10,000-foot, 8-inch bottom-laid pipelines. This facility will provide the POL the Marine Amphibious Force will need from the 18th day after landing to a nominal six months.

Especially designed lightweight and portable SPM fuel buoy is an integral component of a functional and acceptable ATTF. The Laboratory has streamlined existing commercial configurations, adapting industry concepts to match logistical support capabilities of Navy Amphibious Construction Battalions responsible for the installation and operation of the ATTF.

True said the SPM affords safe mooring for tankers in mud and sand seafloors. It can be installed in 65-200 feet of water at virtually any landing beach, in polar, tropical and temperate environments.

The SPM fuel buoy includes a buoy structure weighing less than 130,000 pounds (approximately half the weight of a commercial one) with a diameter of 28 feet and a hull depth of 10 feet. It contains a two-product distribution unit, a cantilevered two-arm rotation unit, and four hawsepipes. It incorporates the American Bureau of Shipping safety factor of two on anchor capacity, and three on chain and structure strength, to give a mooring capacity of 225,000 pounds in any direction. The hawser is a single mooring line 225 feet long and 18 inches in circumference, and is fitted with small lines, resulting in a self-pickup capability.

Briefly, the nominal 17-day installation of ATTF begins with a site survey,

The single point mooring fuel buoy is an integral part of the Amphibious Tanker Terminal Facility. The Naval Civil Engineering Laboratory, Port Hueneme, Calif., developer of an Offshore Bulk Fuel System, designed this lightweight and portable buoy which can transfer 2,000,000 gallons of fuel a day from a tanker to onshore storage facilities.

60 CEC officers complete 'basics'

Sixty new officers joined the ranks of the U.S. Navy's Civil Engineer Corps on September 16, 1983 upon graduation from the Naval School, Civil Engineer Corps Officers, Port Hueneme, Calif., and have accepted assignments all over the world.

Class Number 168 completed eight weeks of specialized training pertinent to the Navy's needs for shore installation engineering, public works management, and Seabee operations.

Nine graduated with honors: Ensign Bruce Dammeier was the outstanding graduate. Eight graduated with distinction: Lt. Robert T. Merton, Lt. James S. Stirling, Ensign Michael R. Huffman, Ensign Douglas G. Morton, Ensign Karen Natsuhara, Ensign Thomas C. Nicholas, Ensign Marie Prebilsky, and Ensign Michael S. Redman. Ensign's photograph is indicated by (★). Students graduating with distinction are indicated by (•) and those entering Seabee duty by (†).

★ ENS Bruce F. Dammeier
BSOE/USNA
to Silverdale, Wash.

LTJG Mark C. Ashley
BSOE/USNA
to Memphis, Tenn.

ENS Catherine A. Ballinger
BSCE/U. of Calif.
to San Diego, Calif.

ENS Matthew R. Beebe
BSCE/Clarkson Coll.
to Argentia, Newfoundland

ENS Steven G. Bartolaccini
BSEE/Marquette U.
to New London, Conn.

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Around-the-clock work could be a vital time saver

beach preparation, and anchor/chain preparation occurring simultaneously. After four days, anchors and chain legs are ready for installation. The pipeline is ready on the beach for preassembly into 100-foot lengths and towout.

During the next five days, the anchors are installed and the two 10,000-foot pipelines are towed into position. On the 10th day, the PLEM is connected to the pipeline hoses and anchored on the seafloor.

From Day 11 through 15, the mooring legs are connected to the SPM, and the adjusting of the buoy position and chain pretensioning is completed. Connection of the underbuoy and offbuoy floating hoses and hawser are completed on the 17th day.

The nominal 17-day ATTF installation requires 10-hour work days, four powered and seven non-powered work barges, a maximum 95 workers on any given day, and an inventory of equipment that includes cranes, bulldozers, rough terrain forklifts, and air compressors.

But faster installation times are being sought. True said a nine-day installation could be achieved when the following pending improvements are incorporated into the operations:

- With more personnel, around-the-clock work could prove a vital time saver.
- Special chain packaging and placement of a portable windlass on the chain-deployment vessel would eliminate the need to transport the chain to the beach.

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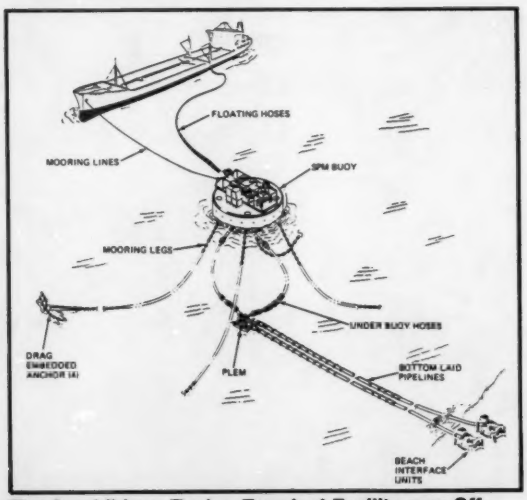
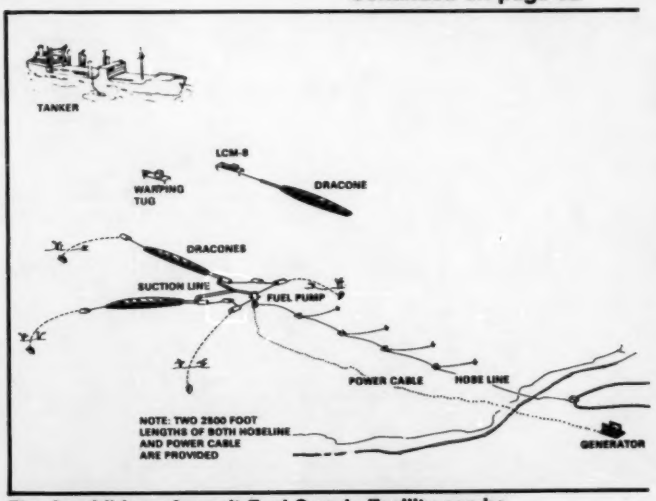


The Amphibious Tanker Terminal Facility new Offshore Bulk Fuel System is being developed at Port Hueneme, Calif.



The Amphibious Assault Fuel Supply Facility can be installed within three days to provide 440,000 gallons of fuel a day to military forces ashore. This facility is a component of an Offshore Bulk Fuel System.

Basic Class No. 168 graduated on Sept. 16, 1983

ENS Stephen E. Bonczek
BSCE/U/ of Ill.
to Moffett Field, Calif.

ENS Michael S. Bowers
BSSE/USNA
to Oakland, Calif.

ENS Carolyn J. Bowling
BSEE/USNA
to San Diego, Calif.

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BSME/Tri-State U.
to Great Lakes, Ill.

LT Kenneth P. Butrym
BSME/Marquette U.
to Yokosuka, Japan

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BSAE/USNA
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† **ENS David R. Cozier**
BSCE/New England Coll.
to Port Hueneme, Calif.

† **ENS Cory J. Crebbin**
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to Gulfport, Miss.

LT Pamela I. Dullum
BSCE/U. of Minn.
to Diego Garcia

ENS Douglas A. Frey
BSCE/Worcester Poly.
to El Toro, Calif.

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Continued on inside back cover

Offshore fuel system

- The PLEM, underbuoy hoses, and pipeline end hoses might be replaced with 300-foot lengths of flexible pipe.
- A second chain tensioner could be placed on the SPM, allowing chain connection and tensioning on two legs simultaneously.
- The use of three support vessels would permit the towout of two pipes at the same time.

A prototype ATTF has been developed, tested and improved during the last three years. Test results of at-sea installations of the new SPM have revealed no major difficulties during the offloading, hose assembly, pipeline and PLEM installation, or positioning of the four anchor legs.

During final fleet operational evaluation tests this summer, data showed that the nominal 17-day installation with existing design can be completed in 14 days under favorable environmental conditions.

Although designed to provide the Navy with a capability to respond quickly with logistical support during a major amphibious operation, OBFS technology can be adapted by the offshore oil and transport industries. With the use of the expedient ATTF installation procedures and hardware designs, commercial moorings can be temporarily installed where weather windows for installation are severely limited, where specialized ocean construction platforms are not readily available, or where construction diver assistance is limited.

Diver involvement in the ATTF installation is limited to observation, measurements and inspection at maximum depths of 150 feet. All construction work, such as securing underbuoy hoses to the buoy after PLEM installation, is done at maximum depths of 30 feet. □

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